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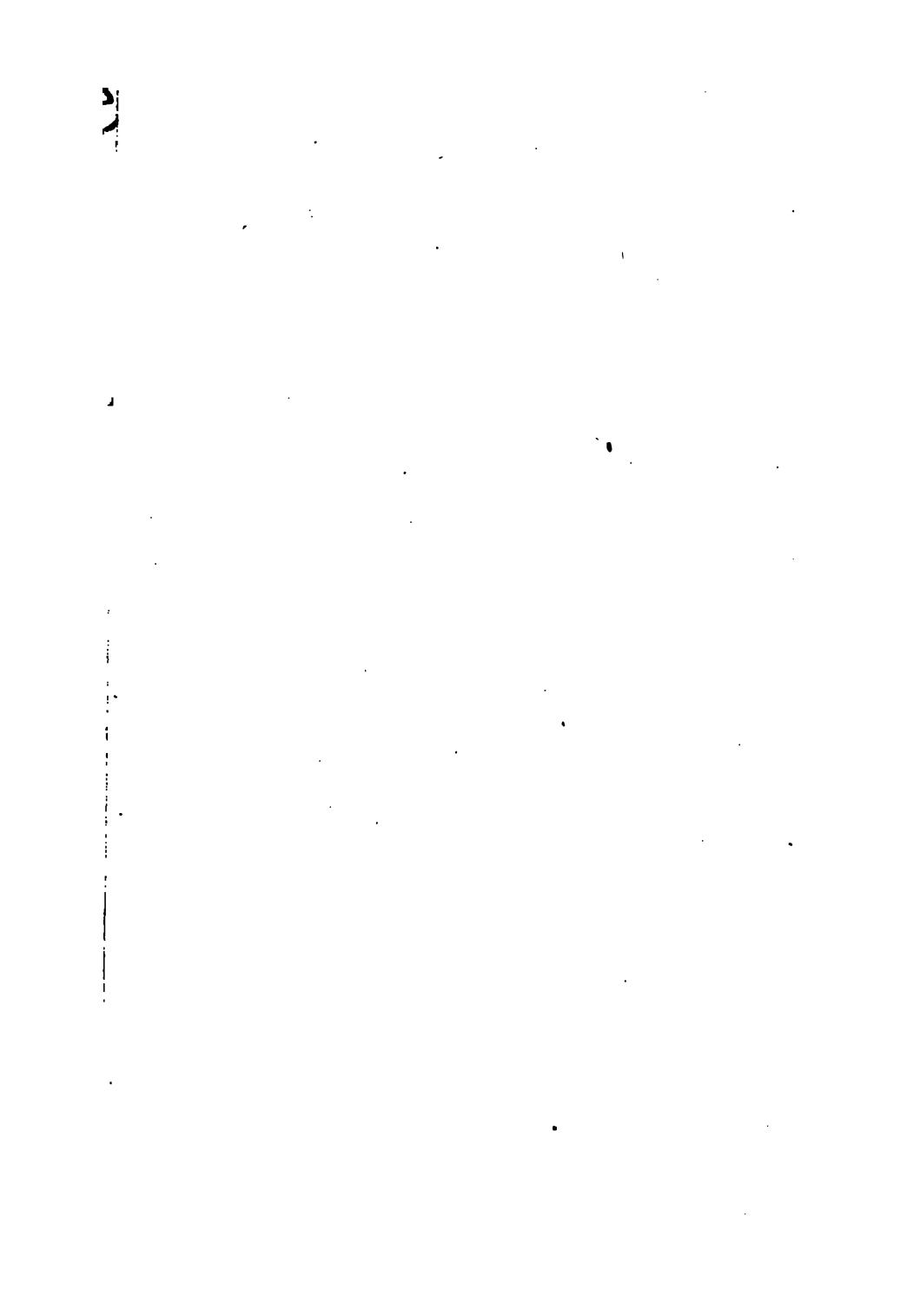
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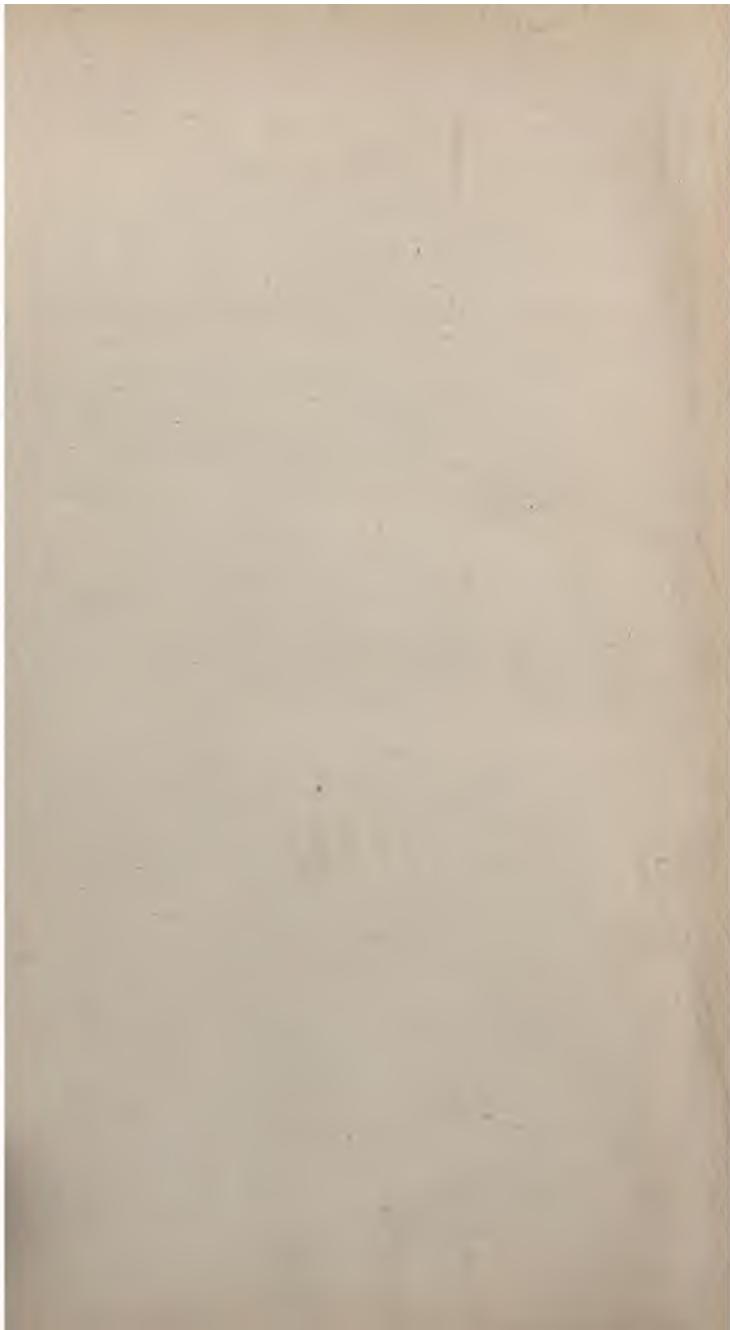


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DENTITION
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ITS DERANGEMENTS.

A COURSE OF LECTURES DELIVERED IN THE
NEW YORK MEDICAL COLLEGE.

BY

A. JACOBI, M.D.,

(PROF. OF INFANTILE PATHOLOGY AND THERAPEUTICS, ETC.



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P R E F A C E.

THE publication of these lectures in the *American Medical Times*, from the columns of which this pamphlet is copied, has been several times interrupted. To say the truth, I have sometimes doubted if they really deserved to be published, and once I have stopped their publication when the appearance, in England, of a new book on dentition, made me believe in the entire superfluousness of mine. The perusal, however, of Mr. Hanks's little work, which is by no means destined for circulation among the profession but still more, the kind attention paid to my publications by the *Medical Times and Gazette*, the *Dental Cosmos*, and other journals and finally, the encouragement bestowed upon me by many of the best men of our country, both personally and through letters, have induced me not to allow them to remain unfinished.

Several times, friends have made the jesting remark that I ought to change the title of my book, and call it a treatise on infantile pathology. It is true that a large number of subjects have been treated of, but it is not my fault if it be

still necessary to review a large share of the diseases of infantile age, in order to decide upon their dependency on, or independence of, or connexion with, dentition. It is further true, that now and then a passage has, to some extent, a polemical appearance, but the cause must be sought for in the fact, which I am sorry to acknowledge, that polemics are not yet untimely in regard to the subject. At all events I have tried to be earnest and honest, and to deceive neither myself nor others.

The profession—I have written for the profession only—will please not withhold their opinions on my treatise. As for myself I have tried to do justice to both the subject and its literature. While studiously avoiding the array of the hundreds of book-titles and headings of articles and essays, I trust that the perusal of this pamphlet will not only prove my acquaintance with the literature of the subject, but the frequently mentioned names of previous writers will, I hope, convince my readers of my desire to give credit wherever it is due.

A. JACOBI.

50 AMITY ST., NEW YORK,
Oct. 6, 1862.

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DENTITION AND ITS DERANGEMENTS.

LECTURE I.

Introduction.—Teething a Physiological Process.—Supposed to be both a Source of Diseases and a Disease itself.—Deaths from Teething.—Meaning of the term Teething.—Symptoms attributed to Teething.—Errors and Prejudices of both Public and Physicians.

To a truly scientific physician, nothing is more evident, than that the physiology and pathology of the human organism have not been sufficiently elucidated. The medical sciences are by no means completely developed; they never will be, for they combine a knowledge of all the varied and intimate physiological functions and obscure pathological changes of the physical and mental organs of the human frame; they never can be, for their basis, the human organism, will and must undergo changes and further development. Those powerful minds who have done most, and are still in our times working most successfully, for the advancement of medical knowledge, have been and are still the first to admit the truth of this proposition, and are the first also to acknowledge that more remains to be done than has been done hitherto. Fortunately, however, there are a large number of subjects so well known and so clearly understood, that even in this ever-changing science we are enabled to point out the way to further investigations, to arrange in mathematical order our conclusions, and win thereby for medical science not only a place amongst the so-called exact sciences, but the acknowledgment of educated men, that it is the noblest and most comprehensive amongst them.

Having the honor, as I believe, of being the first in this country to teach infantile pathology as a distinct and fully independent branch of medical education, I did not deem it proper to begin with a subject liable to be misunderstood,

mistaken, or misconstrued. A subject of this description I have therefore determined, in this preliminary course, to consider at length, viz. the Physiology and Pathology of Dentition—a subject which is but imperfectly understood. But there should be nothing mysterious about it; the process of the early formation and the final development of teeth is well understood, and on this safe basis we are able to rest our conclusions relating to pathology and therapeutics. So little, however, can we rely on the correct interpretation of facts by observers, that even here we shall have to contend with prejudice and ignorance.

You know that among the public at large, even among the educated part of the community, teething is regarded as one of the two scapegoats of all the diseases of infantile age. Teething and worms are among mothers acknowledged as the universal and all-powerful sources of disease. Whenever an innocent ascaris or a puny oxyuris is observed in the faeces of a child, worms are, for years to come, considered as the undoubted cause of any disease that may occur. Teething, a normal, physiological development, taking place at an age which for many reasons is subject to a large number of diseases, has a strong hold on the imagination of frightened maternal minds. The first dentition generally occupies the first two years of early infantile life; a period in which the child is peculiarly liable to diseases both numerous and frequently of a dangerous character. As the protrusion of a tooth (and in the average a tooth will cut every month) is a remarkable phenomenon, and is something new and visible to the eyes of even the most shortsighted, it is believed to be the cause of every unfavorable occurrence in early life. A mother will bring to you her child, thin, emaciated, and anemic, with sunken eyes and the wrinkled physiognomy of old age, and tell you that she is well aware the poor thing is suffering from teething, and that therefore nothing can be done to alleviate its sufferings. She will never be convinced that her child is dying from her own neglect; but she has allowed a slight catarrh of the intestines, perhaps, to degenerate into incurable ulceration of their follicles. Thus you will learn that ignorance and prejudice will attribute all, or nearly all, the diseases of the infantile age to a normal process. To the same cause are attributed inflammations of all the external and internal

organs, the brain and its membranes, air passages and lungs, mouth, throat, stomach, and intestinal canal; as also cough, vomiting, diarrhoea, and dysentery, derangements of the secretion and emission of urine, chronic eruptions of the skin, convulsions and paralysis, exudations of serum, and extravasations of blood, in any of the numerous organs of the infantile body. Teething is thus considered the efficient cause of most of the terrible diseases which prove fatal to thousands of the rising generation. I can assure you that the readiness to attribute all the diseases of infantile life to teething has destroyed more human beings than many of the wars described in history. For though parents are so much impressed with the belief of the dangers of teething, still they never think of attempting to save the lives of their children by counteracting the supposed life-endangering power of a normal process.

The common supposition that teething is a predisposing cause of disease, nay, even a disease in itself, prevails over all civilized and half-civilized countries. What is now, however, the belief of the public, has been the conviction of the medical world through centuries, almost down to the present time. General experience shows that the persuasion of the scientific world, after having been given up to make room for more correct opinions, has remained in the public at large; and it is to be feared that it will not soon be removed. And it would be fortunate if this prejudice were confined to the public. But unfortunately it still lingers in the medical profession, and it is for this reason that I have dwelt upon it so lengthily. Nothing is more common, than to hear doctors of medicine, young and old, in cases of infantile disease, diagnosticate teething, after mother and nurse have done so before; and nothing is more frequent than to be told that the death of a child was the consequence of dentition. I have seen, in this city, a certificate of death, in which the direct cause of the death of a child five years of age, with his jaws full of teeth, was attributed to teething. Consider for one moment the absurdity of the conclusion that a normal, physiological process is fatal to the existence of a living being. Who has ever ventured to assert that menstruation, or pregnancy, or the climacteric years, are the direct causes of death? It is equally absurd to assert it of dentition; yet such

statements are daily made by physicians. According to the census of England, in the year 1857, there were in the United Kingdom 3,992 deaths from teething, 3,791 of which occurred in children of less than two years; 201 in children of from two to five years. Between the years 1845 and 1850, there have died in London, according to the report of the registrar-general, no less than 3,466 infants from teething, and the disorders caused by the general irritation attending dentition; the total number of deaths from all causes being 258,271, giving the proportion of one death from teething to seventy-four from all causes. And the census of the state of New York offers the following numbers: In the whole state there died, in the year 1855, from teething, 626 children; of these certificates of causes of death, 254 were made in New York County, 132 in Kings, 35 in Erie, 24 in Rensselaer, 41 in Albany, 30 in Monroe. It is not stated whether a part of those unfortunate children who died from teething had not the full contingent set of teeth of first dentition.

Let me first state that teething, in the common acceptance of the term, is not the gradual development or formation of teeth, but the time and act of their penetrating the gums. This takes place, in the average, beginning from the sixth, seventh, or eighth months to the twenty-fourth or thirtieth month of life. I may also in this place enumerate the symptoms which are often observed during, or (shall I say) in consequence of teething. In a large number there are no symptoms at all. The first, and the second, and perhaps all the other teeth, will cut, and without any disease or trouble of any kind. In others the mouth is hot and red, with the exception of those thin parts of the gums below which the teeth are visible; even the lips have a higher color and temperature; the child puts its fingers, or anything in its reach, into the mouth; is pleased with having its gums rubbed; bites the nipple when sucking; or if the mouth is inflamed and aphæ are present, and the tonsils swollen, it is disinclined to take the breast, trying it often, but just as often loosing its hold. At the same time there is a copious salivation, the saliva being usually tough, viscid, and more like mucus than saliva. The child has all the usual symptoms of slight or moderate fever; warm hands, a rapid pulse, flushed or pale face, intense

thirst, vomiting, constipation, or diarrhoea with green mucous passages. The most common of these is diarrhoea. Pain in the bowels is very common, as digestion appears disturbed; tears are secreted abundantly; the bloodvessels of the conjunctive are injected. A slight cough, hoarseness, pain in passing the scanty urine, secretion from the nose, are not unfrequent occurrences. Such symptoms are apt to disappear entirely in three or four days or a week, with or without treatment. But sometimes the symptoms are graver from the beginning, or they are aggravated by endemic or epidemic influences, or the peculiarities of individual dispositions to disease.

In some cases the fever will not disappear so readily without leaving grave consequences; the pulsations of the heart and arteries will not decrease in number; the action of the heart will not be of less power and impetuosity than before; the tongue, mouth, and lips remain dry; thirst so extreme that you cannot take the tumbler from your little patient's hands before he has completely emptied it. Respiration is accelerated, numerous, short, and superficial. The eye is sensitive to the light; headache becomes manifest from the corrugation of the muscles of the eyebrows, and the peculiar aspect of suffering. Excretions and secretions are scanty, faeces dry and hard, urine red. Vomiting and diarrhoea, if they had been present before, now cease. The child will appear more depressed, but easily excited; slight local convulsions will prove the introduction to severe attacks, which generally terminate fatally. In other cases the tongue is hard, dry, black; teeth and lips of the same color, corresponding with the symptoms characteristic of typhoid fever. Such cases are very likely to terminate fatally. The last symptoms in such cases are paralysis of some abdominal organ, especially of some part of the intestine. Another train of symptoms attributed to teething, is the following: A child is feverish; pulse frequent and small; temperature of the extremities considerable; but the face is pale from the beginning; lips and mucous membrane of the mouth hot, red, and dry; tongue covered with a greyish white fur; restlessness; anxiety; respiration hurried and short; vomiting and diarrhoea. Frequently such a depression of the general strength is combined with these symptoms—the more so as the most intense and often repeated

vomiting and diarrhoea are very apt to exhaust the little patients—that the child dies in a day or two in convulsions consequent upon inanition, and local or general paralysis. In a certain number of cases the principal symptoms cease, and the child recovers. In a certain other number vomiting will stop, but the diarrhoea continues. The deluded mother who felt a little uneasy at the severe character which teething seemed to have assumed, is gratified, after the main symptoms have passed by, to find that her child is suffering from diarrhoea only, and that in this manner teething will be made easy and comfortable. But alas! this deception on the part of the mother is too often fatal to the child. The diarrhoea is allowed to go on for days and weary weeks; the digestion becomes hopelessly destroyed; the abdomen immensely distended with gas; the mesenteric glands swollen and impermeable to chyme; the catarrh and over secretion of the glandular follicles of the intestine lead to deep ulcerations of the intestinal canal; the diarrhoea becomes also more frequent, serous, mucous, or bloody; the arms and legs of the little sufferer dwindle away; and the countenance becomes emaciated and senile. The scene closes with a consoling certificate from some doctor or druggist, affirming that teething was the cause of death. Thus millions of infants are destroyed by ignorant, prejudiced, and incorrigible advisers. I say incorrigible. I know that mothers will always consult their prejudices first, the prejudices of their neighbors next, perhaps at some late time common sense, and finally they may seek the advice of an educated medical man. I know that a mother who has just consigned a beloved child to the grave, will go home with throbbing heart, and repeat the follies which cost her the child she has lost. If you remonstrate with her for neglecting the second, as she did the first, she will reply, Was not the child teething? Would you prevent the child from teething naturally? Is not teething necessary? Was it her fault that the child got teeth with difficulty? The true inference would be that nature neglected much, and that it was greatly at fault in the matter of dentition. I once read the newspaper announcement of the death of a child, in which the parents, while inviting all their friends and acquaintances to attend the funeral, affirmed that "the Lord hauled the dear child

up to heaven by the teeth." Now, in this case, neither the father nor mother was at fault.

I shall not, in this place, proceed to point out the other symptoms of diseases attributed, whether rightly or wrongly, to teething, as the symptoms of cerebral inflammations, of convulsions, of general and local paralysis. At a later period in this course of lectures, I shall return to these subjects for practical purposes. It will better answer my design to give you a sketch of what dentition is, anatomically and physiologically, in order to show clearly the normal and abnormal course it may take. I shall thus be able to explain and *limit* the numberless complaints generally attributed to teething. If I can relieve your minds of the impression that dentition destroys the thousands and even tens of thousands of innocent beings who are yearly sacrificed in reality to the prejudices of other times, I shall be abundantly satisfied.

LECTURE II.

Development and Growth of Teeth.—Time and Order of Teething.—Deviations from both Order and Time of Teething.—Congenital Teeth.—Their Nature.—Influence of Extracting Congenital and Deciduous Teeth.—Malposition and Double Rows of Teeth.—Late Teething.—Entire or partial Absence of the Teeth.—Relation of late Teething to Constitutional Disorder.

ALTHOUGH the earliest development of teeth is of considerable importance, I shall not dwell upon it longer than is necessary to a simple elucidation of the process. A knowledge of the origin of the teeth, and their first development, is, however, required in order to understand the manner of their final protrusion through the gums. The rudiments of the teeth are observed as early as the sixth week of foetal life, when the embryo weighs but fifteen grains, and is little more than half an inch in length. A deep groove first appears lined with mucous membrane, within the external alveolar margin of the upper maxillary bone. It has been named, by Goodisir, the primitive dental groove. According to the concise description of the anatomical researches on the formation of teeth, given by Harrison, the germ of the anterior deciduous molar tooth is formed first, appearing as a small papilla on the floor of the primitive dental groove; next the germs of the canine teeth are formed in the same manner; and about the tenth week of foetal life those of the incisors, and lastly those of the posterior deciduous molar teeth. This *papillary* stage is followed by the *follicular* and *saccular*, from the fourth or fifth months of foetal life upwards. Delicate processes extend from the sides of the primitive dental grooves over each papilla, and by meeting before and behind it, inclose it in an open follicle. About this time the papille begin to change their form, and to assume that of the future teeth. The follicles become closed by membranous processes extending over the margins, and form sacs which continue from the fifth month of foetal life to the period of the eruption of the teeth at different periods after birth.

The osseous development of the teeth commences at this period. Without any preceding formation of cartilaginous substance we discover an osseous deposit on the dental pulp, which increasing in size from the surface of the sac, augments its volume from day to day. The dental pulp, wherever it is covered with this osseous layer, has a reddish tinge, more so than its other parts. The deposition of osseous matter on the dental pulp commences either from its surface, or from the contents of the sac, probably from either; the half-liquid contents of the sac continually increasing their percentage of phosphate of lime. When the ivory shell is formed in the dental sac, the interior of its parietal layer has a villous and vascular appearance, like mucous membrane, with a thin layer of granular matter upon it, which may be considered as a sort of epithelium lining the interior of the original follicles. This surface is the matrix of the enamel; it is impossible for this substance to be produced by or from the original pulp, or from its blood-vessels, as the latter has been enveloped in the ivory shell. The enamel appears first in minute crystalline, calcareous particles. It is not very hard, nor thick at first, but solidifies gradually and adheres closely to the ivory, from which it is separated by a thin membrane, like that which is separating the ivory from the pulp.

The cement forms a thin coating around the root or fang, and is formed by the lower or alveolar portion of the dental sac, which invests the root and adheres to it. The order of development of the single teeth depends on the general rule of solidification in the foetal body, which begins in the median line and progresses to either side simultaneously. Thus the inner incisors are formed first, and the posterior molar teeth last, with the exception of the canine, which appear later. Further, teeth in the lower jaw will develop earlier, in correspondence with the earlier ossification of the lower jaw in foetal life. A gradual development is also manifest in the number of dental pulps; in the third month of foetal life there are sixteen, in the fourth twenty.

After the teeth have been perfectly formed, ivory, cement, and enamel being deposited, they protrude from the jaw, penetrate the gums, and become visible in the cavity of the mouth, in consequence of the natural law of

dental growth. The root of the tooth growing, the crown is propelled against the covering of the alveolar sac and the gums. The slight pressure produced thereby gives rise to gradual absorption of the osseous covering, and after this has disappeared, of the gums. By the continued growth of the root of the tooth, and by the progress in the development of the maxillary bone, the tooth is again propelled until the whole crown is visible.

The crown is the part developed first in the dental sac. With it, there is connected a thin and narrow osseous ring; this root of the tooth is gradually progressing to the depth of the dental cavity. While thus the length of the tooth is increasing downwards, the gums and the surface of the jaws are little changed. But with the progress of ossification, both in tooth and jaw, the later normal organization of the jaw becomes manifest. The dental cavity is lengthened, its osseous wall becoming more extended. But the growth of the tooth being more rapid, it commences pressing against the osseous covering. Resorption takes place, not only of the covering bone, but of its periosteum, of the gums, and finally of the mucous membrane of the mouth. In newborn infants the gums are hard, firm, and solid, so much so that it has long been called, though it is cellular tissue, by the term—dental cartilage. Before the cutting of the teeth it is, as it were, their representative, being the only means of taking a firm hold of the nipple. The gums will sometimes exhibit protuberances and cavities that look very much like teeth, the more so as these prominences are generally pale and of whitish color. The almost cartilaginous consistency of the gums disappears after birth; it gradually becomes soft in the course of a few months; its surface, instead of remaining sharp and pointed, grows blunt and thick, and even exhibits a sort of groove; being rounded only in those few cases in which the gums will be affected with an inflammatory process. After the gums have obtained their soft and loose consistency, the penetration of the teeth finds naturally less difficulty.

Eichmann reports four hundred observations on dentition, with accurate notices of the time of the eruption of the several groups of teeth. He concludes that teeth do not appear singly, but generally in groups. The period of the protrusion of the several groups is as follows: .

| | | |
|-----------------------------|---------|------------------------|
| Inferior (middle) incisors | betw. | the 28th and 32d week. |
| Superior " | " " | 36th 40th " |
| Anterior molar teeth | " | 48th 54th " |
| Canine teeth | " | 16th 18th month. |
| First posterior molar teeth | " | 22d 24th " |

At the 27th or 30th month, there are twenty teeth in healthy children.

The following table from Ashburner shows how slight is the difference in the observations of authors.

| | | |
|-------------------|---|---------------------------|
| 7th month | . | 2 central lower incisors. |
| 8th " | . | 2 " upper " |
| 9th " | . | 2 lateral lower " |
| 9th to 10th month | 2 | " upper " |
| 12th " 14th " | . | 4 first molar teeth. |
| 16th " 18th " | . | { 2 lower canine teeth. |
| 19th " 20th " | . | { 2 upper " " |
| 23d " 30th " | . | 4 last molar " |

There is, in fact, but little difference between the two tables, and as a rule you will not find many deviations in healthy children.

The order which teeth generally follow in their appearance is sometimes changed. Thus Fox, in his account of the diseases which affect children during the first dentition, states that the molar teeth have protruded before the lateral incisors. Brunner, also, reports a case in which a molar tooth preceded the other teeth. Lambert found a canine tooth, the only one protruding, in an infant two weeks old, which grew $1\frac{1}{2}$ inches in two weeks. Raw mentions the case of an infant which had a canine tooth before an incisor and Baumès reports the same anomaly to have been met with by a friend of his. Such, however, are rare exceptions to the rule, although anomalies of less extraordinary character will be found from time to time. Thus the lateral incisors will precede, sometimes, the central ones; or the incisors will first appear in the upper jaw, thus reversing the usual order, in which the lower is first to exhibit them. So regular, indeed, is the first appearance of teeth in the lower jaw, that children in whom the anomaly referred to occurs, are thought to be short-lived by the common people of some countries. Naumann thinks this belief is based on

experience, and is inclined to regard it as a fact; and seeking to harmonize public opinion and science, he ventures to offer the following explanation, viz. the appearance of teeth first in the upper jaw proves a precocious development of the upper jaw, and, consequently, of the whole skull; the brain participates in this premature development, and increased irritation and cerebral symptoms necessarily follow. At a later period, in this course, I shall take occasion to show how much truth there is in this popular belief, by explaining in what manner abnormalities in the cutting of teeth are important, not as causes, but as symptoms, of anomalous development of the cranium in general; and in what manner the brain may be injured and life endangered by such anomalies.

A change in the order of the protrusion of the teeth is not the only anomaly that we meet with, for the time of their first protrusion will sometimes be found to differ much from the average age of their appearance. The first variation of this kind which I will notice, is the appearance of teeth at birth. This singular anomaly has now been observed many times, as the following examples which I have been able to collect, will abundantly prove:

The younger Pliny states that the renowned Marcus Curius, consul of the Roman republic 270 years before our era, had a full set of teeth at birth. This was the reason of his being named, Dentatus. The same author mentions the case of Papyrius, and of a lady, named Valeria, who had all their teeth at birth. Zoroaster, the Persian legislator, is also reported to have had all his teeth at birth. The old historians, from whom Weinrich took the facts, probably thought he was destined to become the exponent of wisdom and morals, from being so extraordinarily and precociously gifted. Louis XIV. of France, whom some writers call the great, because he lived contemporaneously with some great men of his country, was born with two teeth; as was also his Secretary of State, Cardinal Mazarin. The celebrated Grotius, who then lived in France, prophesied that the royal baby would prove a dangerous character, and that like the nipples of his wet-nurses, bleeding and torn by the voracious infant, the neighboring sovereigns would be the subjects of the depredations and robberies of the future king. Scottus, in his *Physiologia curiosa*, relates, from a

report of Nieremberg's, the case of a Spanish dwarf, who had all his teeth when born, and never lost one of them, got a beard in his seventh, and had a son in his tenth year. Old Heister repeats the report of Kauliz, of a child, born with two incisors, which soon turned black; the child grew thin and emaciated, and died with rachitis when a year old. In Büchner's collections there is the case of an infant, twelve days old, who had teeth, and died soon after of a papulous and vesicular eruption, with consecutive desquamation (hereditary syphilis?). Lanzoni reports the case of a newborn infant with two rows of teeth.

We learn from Schurig, that Crausius observed two incisors in the lower jaw of a fetus in the sixth month of utero-gestation. Schenk reports a similar case. It is stated in *Vita Peirescii*, that a woman gave birth to a child with long hair and teeth. Thomas Bartholinus is of the opinion that such congenital teeth are the cause of the *vagitus uterinus*. Güldenkiel reports the case of the daughter of Navinius, an officer at Camenz, who was born with two incisors. Helwich has several cases of boys born with teeth in the lower jaw; and Daniel Ludovicus relates the cases of newborn girls, having teeth in either jaw, and injuring their tongues by them. Similar cases have been reported by Johann Rhodius, Goeckel, Mazarinus, Simon Majolus, Alexander Benedictus, Hildanus, Balduinus, and Polydorus Virgilius.

Gensel reports the case of a boy who was born with two incisors. Schlenck, E. von Siebold, J. Ph. Horn, Mercklin, and Storch, have seen the like, without, however, mentioning the sex of the children. Vesti relates the case of his own daughter, who was born with a tooth. Detharding observed a tooth in a fetus of six months; another in an infant three days old; and four teeth in a newborn infant. J. F. Lobstein gives the case of a child born twenty days after the ninth month of utero-gestation, with six incisors. Reveillé-Parise met with four canine teeth in an infant of four weeks, two of which had cut before birth; the development of the other teeth was equally precocious. Meissner saw two incisors in a newborn child, one of which fell out in the course of a few days; in another case the same thing happened, but a second tooth followed soon after, both of which were firmly imbedded in their alveoli and proved

to be of the same nature as temporary teeth generally. Two incisors, observed in a newborn infant in the Paris founding hospital, by Billard, fell out after six weeks. Mende observed two upper incisors in an infant; they were loose and movable, produced pain when touched; the mouth had an oblique direction, and the margins of the maxillæ were connected with each other. Although the teeth were extracted, the infant was unable to suck, and died of trismus on the fourth day after birth. Canton reports the case of a child in the practice of Dr. Tomes, born with two teeth in the lower jaw, by which the breast of the mother, and its own upper jaw, had been injured. On examination he found two sharp, rough incisors, protruding from the centre of the lower jaw. They were ill-shaped, imperfectly coated with enamel, and loose in the gum, and stood across, instead of in a line with the alveolar arch. They were removed, and it was found that the fangs were not more than one-third developed. In fact, the teeth had attained about the normal amount of development for the age of the child, but had protruded through the gums before they were fitted for eruption. An after-process had been effected before the preparatory one had been completed. A similar case occurred in Canton's own practice. Brown mentions the case of a child born with the central incisors through the gums. They were extracted. Two other children were afterwards born of the same mother, in each of whom the same anomaly was found. All the children were females. The teeth were allowed to remain. Crump and Lethbridge have each observed a case of complete dentition at birth; the case of the former observer occurring in a still-born negro child. The sockets were very imperfectly formed. Baumès, while quoting the cases of congenital teeth observed by Columbus, Van Swieten, Marcellus Donatus, and Antigonus, reports the case of a French lady who bore a girl with two congenital incisors in the upper jaw, followed by two teeth on each side of the former, in the same jaw, three days afterwards. The infant died in convulsions. Richard III., and Mirabeau, the hero of the commencement of the great French revolution, had teeth when they were born. Similar cases are reported by Churchill, Fleming, Denman, while the celebrated Haller collected nineteen. I cannot conclude this long list without

adding that Whitehead, the worthy professor and clinical teacher at Manchester, England, removed two teeth from the lower jaw of a newly born infant, in order to facilitate sucking. They were reproduced at the time when the canine teeth were formed, viz. after a year and a half, instead of the usual time of seven or eight months.

In Billard's opinion congenital teeth are not firm, but are liable to get loose, and be lost; but such is not the experience of Meissner and others. The last author is, as a rule, opposed to the advice of Billard, and the practice of Whitehead, of extracting such premature teeth when they prevent sucking. Meissner's opinion is, that no animal is prevented from sucking by the teeth in its mouth—a theory which is good enough for animals, but not for our race. Whitehead's case, in which it was necessary to remove a tooth to enable the mother to nurse the child, the fact that the nipples are very liable to become sore where the teeth are fully developed before weaning, and finally the few cases reported above, in which congenital teeth did not fall out to give place to the real temporary teeth, are valid proofs against such practice, at least in a number of cases.

Congenital teeth have been made the subject of special remarks by Dr. Nessel, professor of dental surgery at the University of Prague. As his opinions differ somewhat from others, I will state them more definitely. He removed congenital teeth in three cases. In his opinion, they are, properly speaking, not genuine teeth, as they differ greatly in substance and form, and especially in the nature and consistency of their exterior layer. They are less firm and solid, and their enamel is white, but thin, and not formed at all in some parts. They are not inclosed in the dental alveolus, but have a loose attachment merely to the gums. The real teeth will appear afterwards; and his impression is, that such precocious formations are principally observed in individuals who will show the symptoms of general scrofula in more advanced life. He therein coincides with *Capuron's* opinion, who always considers the premature appearance of teeth as a symptom of a morbid constitution. He removed them, not because of any inconvenience to the mother on nursing the infant, but because, in sucking, the tongue is brought forwards, and is liable to become sore and ulcerated from the continued contact. Some of Nes-

sel's remarks correspond with Lassaignac's statements, who, by careful chemical investigations, found the teeth of younger animals to contain more organic matter than the older, as in the case of their bones; but he is certainly mistaken in regard to those congenital teeth which prove to be real temporary teeth.

In Whitehead's cases, and in some others, the extracted teeth were reproduced. The facts, however, are sufficiently numerous, proving that this will not take place in every instance. Indeed it cannot, where the congenital are genuine deciduous teeth.

It is not at all desirable that deciduous teeth should fall out prematurely, or be removed, for the jaw thereby contracts, and undergoes a certain degree of atrophy, and consequently, when the permanent teeth appear, there is not sufficient room. Besides, the permanent teeth are larger than the deciduous teeth, and (as usually happens after the latter have fallen out, or been extracted) they, too, appear before the normal period; the jaw, then, not being sufficiently expanded, they are either out of the normal position, and are arranged in an irregular manner, or they are forced to form two rows. This anomaly cannot be remedied, because, as Canton justly observes, considerable changes take place in the form of the lower jaw-bone, as the child advances in years. The angle formed by the ascending portion, or ramus, is at birth very obtuse, insomuch that under the age of four years it is impossible that the bone can be dislocated. The jaw enlarges, or increases in size at the posterior part, not near the chin, in order that the additional molar teeth which the child acquires at the second dentition, may find space, without disturbing or interfering with the teeth which correspond with those of the temporary set. This growth of the jaw continues up to the adult period of life, when all the permanent teeth have made their appearance. The ramus is then nearly vertical with the body of the maxilla, and forms a right angle with it. When, in old age, all the teeth have been lost, and the alveolar arch is closed by the absorption of the partitions of the sockets, the jaw again changes somewhat in shape, and is, apparently at least, thrown forwards. In some cases another occurrence will take place. The deciduous teeth may be firmly inclosed in the jaw and not

give way to the onward pressure of the permanent set, which thereby are forced to change their direction, and protrude either in front of or behind the deciduous teeth. As in these cases the jaws are fully developed to their proper size, it is not only not injurious but absolutely necessary to remove the deciduous teeth in order to let the permanent set assume their normal position. A second variation is in the position of the teeth, and instead of one row normally developed otherwise, there are two or more. Columbus reports that one of his children had three rows of teeth. Valerius Maximus and Pliny relate similar facts. A son of Mithridates is said to have had two, and Hercules three. Arnold has met with a child of fourteen years having seventy-two teeth, thirty-six being contained in each jaw, and placed in two rows in a very regular manner, with the exception of the incisors, which exhibited some deviation. Baumès gives two similar cases, but in both the children were unhealthy, with feeble constitutions, and a scorbutic condition of their gums. Storch reports a case from an old collection of medical facts and essays; and Lanzoni gives instances of two rows in a new born infant; in a citizen of Ferrara; and lastly, in Louis XIII., King of France, who is said also to have had three rows, by some writers who exaggerate the expression of Bartholinus, who reports the case:—"Item dupli vel triplici ordine dentium, qualem in piscibus nonnullis vidi et qualem Ludovicus XIII. Galliarum rex habuit."

A third variation is the appearance of teeth at a later period than the normal one. Van Swieten gives the case of a girl whose osseous system was well developed, and health perfect, but who had no teeth before the nineteenth month. Rayger relates the case of a girl who got her four temporary canine teeth when thirteen years old; Fauchard, that of a child from five to six years, who had a few incisors only. Brouzet knew a child twelve years old who had but one half of the normal contingent set of teeth, the alveolar margin having the firmness and solidity of the gums of old age. Dugès has seen the first tooth appear in the eleventh, and Sinellie in the twenty-first or twenty-second year. Lanzoni knew a child who had the first tooth, and the power of speaking intelligibly, in the seventh year. Ashburner reports the case of a very delicate though lively

child, with large head, tumid abdomen, and peculiarly small-sized extremities, who cut the first tooth, an upper incisor, at twenty-two months, and remarks that many cases of tardy access of speech, and of stammering, are connected with erroneous development of the teeth. Schoepf Morei, who relates the case of a child who had the first tooth at three months, and eleven at eleven months, has seen a child who had no teeth when several years of age. Maury attended a girl of seven years, who had not her first lower incisors, the space being sufficient for three teeth, and the alveolar processes being low and narrow. I have had under observation a boy to the age of two years and ten months, at which time he had not a tooth, nor a symptom of approaching dentition. The records of the Children's Department of the German Dispensary of the City of New York contain a similar instance in a child of two years of age. Amongst the four hundred observations on dentition reported by Eichmann, there were a few in which the first tooth cut at twenty-two months, and in a case described by Churchill the first tooth cut at seven years of age.

A fourth variation, of which there are a very small number of observations, consists in the absence of teeth. Botallus gives the case of a woman of sixty years who never had a tooth. Oudet is of the opinion that the cause of this anomaly must be looked for in an early inflammation and suppuration of the dental germs. Valla reports the case of Pherecrates, and Baumes that of an adult man who never had teeth.

The fifth anomaly is the absence of a number of teeth, instances of which are also on record. One or two have been mentioned by me. Storch describes the case of his own daughter, who had no canine teeth; Linderer that of a girl fifteen years old, who never had either of the four upper incisors. I have myself known a lady with but two upper incisors.

Finally, the following anomalies of doubtful character may be mentioned:—Plutarch and Valerius Maximus report, that Pyrrhus, king of Epirus, and a son of Prusias, king of Bithynia, had only one bone on each jaw, instead of the full contingent set of teeth. And Bernard Jengha was in possession of a skull, in the upper jaw of which (this being the only one found) only three dental masses

were contained, the central one corresponding with the incisors and canine teeth, and each of the two exterior ones with five molars. Perhaps, however, these cases belong to the class of those described by Eustache and Sabatier, in which a number or a whole set of teeth were incrusted by a hard stony substance, thus producing the impression of a single dental mass, or a limited number of abnormally developed teeth.

As a rule, authors assert that teething at a later period interferes less with general health than at a premature period of life. Morbid symptoms in the former cases are stated to be less frequent. But delayed teething seldom stands as an isolated fact, but is an undoubted proof of some morbid condition in nutrition and general development. In the large majority of cases a notable retardation in the eruption of the teeth is but one of the symptoms of derangement and faulty development of the osseous system and the organism in general. The bones of the infant should be developed with the same equability as its other parts. Premature teething, premature walking, and premature ossification of the cranial bones, usually coexist; so do protracted teething, retardation of walking, and retardation of the ossification of the cranial bones and fontanelles. They are far from being favorable symptoms, and are too frequently the first symptoms of rachitis. Old Heister and Storch were already aware of this fact. To what extent the general health and constitutional vigor correspond with the formation of the teeth, and the development of the osseous system, is clearly shown by the following inquiries of Merei.

Of twenty healthy and robust children, the large cranial fontanel was closed in ten at from eleven to thirteen months; in five at thirteen; in two at fourteen; in two at ten; in one at fifteen. In fourteen of these the first teeth cut at from six to eight months; in four at from eight to nine; in two before the sixth month. Consequently, there is in healthy children, an interval of from four to seven months between the cutting of the first incisors and the closure of the fontanel.

Of eight feeble or sickly, but not rickety, children, the large fontanel was closed in six at from eleven to thirteen; in two at from thirteen to fourteen months of age. In

seven of these the first incisors cut from four to seven months before the closure of the fontanels; in one the cutting of the first tooth, which took place at thirteen months, was directly succeeded by the closure of the fontanel. Thus it appears, that feeble, but not rachitic, children, differ little in the proportionate time in which the several parts of the anorganic portion of the body is developed, except that the general development is usually a little slower.

Of eight rickety children, the fontanel in three was closed in the thirteenth month; symptoms of rachitic mollification of the osseous system developed themselves immediately afterwards; the incisor teeth came at the regular time; the other ones too late. In three the ossification of the cranial fontanel took place between the sixteenth and nineteenth month, the first tooth having made its appearance at the age of twelve months, the others following in rapid succession. In one the large fontanel was open at nineteen months; the first teeth cut at the regular time, while rachitis was not yet present; but at eighteen months there were but eight teeth present. In one case of severe rachitis, neither the fontanel was closed, nor had the eruption of a single tooth taken place at the age of twenty-five months. I have deemed it important thus to consider the anomalies of dentition and the connexion of the eruption of teeth with the development of the osseous system, and finally allude, in passing, to its relations to the general health, and the constitution of the patient.

LECTURE III.

Anomalies of the Enamel both Morbid and Healthy.—Milk Teeth in Hereditary Syphilis, Rachitis, and Scrofula.—Influence of Malnutrition, Abuse of Sugar.—Physiological Remarks on appropriate Food.—Attention to Milk Teeth.—Their Influence on Digestion and Pronunciation.—Cleanliness.—Sucking Bags.—Extraction of Milk Teeth and its Influence on Permanent Teeth.

THE enamel of the teeth is subject to several anomalies. It may be either defective or discolored. Its defective formation appears either in excavations dispersed over the surface of the tooth, or there are complete furrows or transversal notches around the crown of the tooth, the body being still covered with, or entirely deprived of enamel. This atrophy is the result of those severe diseases which the child may have been suffering from during the development of the enamel. Acute exanthems are said to produce the dispersed excavations; acute inflammatory diseases the furrows; and rachitis has often been observed to be the cause of the entire absence of the enamel. The incisors of rachitic children are usually small, appear late, and are very liable to become carious. Acute exanthems are counted among the causes of this anomaly, especially by such writers as classify the teeth with the dermal tissue. Small-pox is related to produce isolated excavations which have a great similarity to the cicatrices remaining after small-pox. To vaccination also some have attributed the defective development of the enamel. Such children as were vaccinated before any tooth appeared, or after their complete development, had finer teeth than those who were vaccinated during their protrusion and growth.

According to Prof. Nessel, the age can be determined in which a child was affected with a severe disease, from the species of teeth affected, and the distance from the top of the crown in which excavations or furrows are found. If the incisors and the first molars are defective in enamel, the disease ran its course between the twelfth and eighteenth months, whereas a disease of the fourth or fifth year will leave its vestiges in the second molars. The longer

its duration, the broader the furrows. Where the disease returns at different periods, there are often furrows at different heights. Prof. Nessel is of the opinion that this abnormal condition is the effect of a severe disease, influencing as well the membrane outside the ivory, from which the enamel is deposited, as any other part of the organism, but does not depend on supposed abnormal acidity of the liquid contained in the dental sac. For if this were the cause we should expect the enamel to be defective all over below the line that was formed before the disease occurred. Whichever may be the cause, the anomaly cannot be removed. It would be aggravated by levelling the surface of the tooth, as extensive caries would be the immediate consequence.

Another anomaly of the enamel is its discoloration. Brownish spots are the result of original development and composition. White spots are sometimes the effects of mechanical injuries producing local disorganization of the enamel. They consist of carbonate of lime instead of the phosphate and fluate, and from the fragility of the enamel at these places are apt to give rise to carious degeneration.

The anomalies described cannot be mistaken for those irregularities of shape, such as furrows extending around a whole tooth, which are sometimes observed as family peculiarities. Such teeth are generally hard and solid; have very little tendency to become carious or wear prematurely, and differ widely from those soft and friable teeth which are due to the arrest of development in early infancy, by either hereditary predisposition, or accidentally contracted severe disease, or protracted mal-nutrition.

To Mr. Hutchinson, of London, the profession is indebted for a number of good observations on the influence of hereditary syphilis on the development of the teeth. Although the majority of his remarks relate to the permanent teeth, in which this hereditary malady exhibits itself best, there are some morbid symptoms in the temporary teeth belonging to this class. The temporary teeth, in hereditary syphilis, do not present any peculiarities of form; they are, however, often of bad color, and are very liable to early decay. The central upper incisors are the first to suffer from caries and often crumble away under its influence, within a year of their being cut. The upper lateral incisors soon follow,

but the canines very rarely indeed. The caries generally attacks the neck of the tooth, and rapidly penetrates through it, causing the crown to crumble away, soon after which the fang falls out. Children who have suffered severely from syphilitic stomatitis, are often toothless as regards the whole of the upper incisors, from the second year till the permanent set are cut. Occasionally, the lower incisors suffer in the same way, but far more seldom than the upper ones. The deciduous canines rarely either become carious or drop out. They are, however, liable to a curious kind of circular wearing away, a sort of tusk or peg remaining in the centre of each tooth; the process of circular attrition having commenced a little above the level of the dental neck. This condition Mr. Hutchinson has seen in but five or six cases, and in all these it was symmetrical on both sides, and in both upper and lower sets; he has never yet seen it excepting in syphilitic children. It is not usually produced in any very morbid degree until about the age of six or eight years. He has met with an approach to it in one of the molar teeth of a syphilitic child. The outer layer must, at least, be of a peculiar and abnormal softness to be worn away so singularly.

Original disposition is not an uncommon cause of the enamel being deposited in a thin transparent layer only. The children in whom it occurs, are usually of weak and feeble constitution, and particularly defective as to the development of their osseous system in general. Transparency of teeth according to Rudolph, and bluish white color according to Duval, are symptoms of rachitis; semi-transparency, as of horn, of herpetic predisposition; semi-transparency and milk-white color, of scrofula and tubercles; yellow and white spots, intermingled, of derangement of general development; small, white, yellow, or brown spots, of commencing caries. Yellowish white color, and average hardness, are found in the most durable and solid teeth.

There is one agent, the influence of which appears to be particularly dangerous. I allude to sugar. It has long been considered by physicians and the public as the cause of many cases of caries of the teeth. Its tendency to be transformed into acid is well known. Every acid is liable to disorganize the enamel of the teeth. It is proven by

direct experiments that sugar dissolved in water, and exposed to a certain temperature and a continued afflux of atmospheric air, would not disorganize enamel, although this were kept in the solution for many weeks after the transformation of sugar into acid has taken place. There is, however, a difference in the transposition of sugar, according to whether it takes place in a tumbler or on the teeth. The change is more rapid on the teeth than otherwise, from the fact that the air is constantly renewed in the mouth. Thus it is, that the enamel of the anterior side of a tooth is more often affected first, for the common observation is, that the anterior and lateral surfaces of the teeth are affected, badly developed, cracked, or their enamel entirely absent, while the posterior surface is proportionately uninjured. Slight though the effect may be for some time, it will prove dangerous to the normal condition of the tooth whenever frequent repetitions of the same injury take place. However this may be, this is certain, that there are some writers who deny the injurious effect of the sugar on the teeth, from the fact that the negroes on sugar plantations have the most beautiful and strongest teeth. Perhaps the lime which is usually contained in refined sugar has something to do with the deleterious influence on the dental structure. Such, at least, is the opinion of Hille, who observed both negroes and creoles of Surinam to have beautiful and white teeth, although they are constantly using sugar, but unrefined. The same author, however, adds the remark, that the unrefined sugar also is not prepared without lime, but he is inclined to attribute the health of the teeth to the absence of scrofula in that island. In the Netherlands he found, together with the general prevalence of serofulvous diseases, early decay of teeth. Falck, in his researches on diabetes mellitus, observed caries of the teeth in many instances; he does not attribute this anomaly to the direct influence of sugar, but to its transformation into lactic acid. This transformation takes place readily by the action of saliva, which is generally found to be acid in persons suffering from diabetes.

Fruit, both sour and sweet, are known to destroy the dental structure. Even in adults the same disastrous result is observed. Therefore, in allowing fruit to children, Spiel-

berger's advice is very good, viz.: Let the juice be absorbed, and removed from the teeth, by the simultaneous use of either bread or water.

One of the most injurious agents in destroying the teeth is the sudden change of temperature. Of the different layers, enamel, ivory, etc., a sudden change of temperature will affect more the outer than the inner one; the enamel will be liable to crack without being thrown off, as there is an organic connexion between enamel and ivory; but in the cracks acids, or any other injurious substance, will succeed more rapidly in disorganizing the structure.

As malnutrition is among the principal causes affecting the healthy composition of teeth, it is necessary to know the kind of food which is proper for children before and during dentition. Previous to the eruption of the first teeth, infants do not masticate; consequently, as a uniform rule, the food must be such as does not require mastication. Milk and soups are appropriate to this age. Amylaceous substances must be avoided, at least as a general nourishment, for a number of months; with the exception of those cases in which, for professional purposes, you think proper to allow them. Saliva, which is absolutely necessary for their digestion, is secreted in too small quantities in the very first months of life; thus the digestion of arrowroot, and farina, and rice-flour, and all the other amylacea is thrown upon the digestive powers of the stomach, then undeveloped in its muscular structure, and unprepared, from the amount and kind of its secretions, for difficult digestion. If you cannot expect amylaceous matters to be readily digested, even when suspended in water and milk, how much less in a dry form, without the admixture of any liquid, as it is frequently given? Frequently the instinct of the mother is seen to correct, in some manner, the insufficiency of infantile digestion, by first masticating and soaking with her own saliva the bread, or cracker, etc., destined for her infant. This is an aid to infantile digestion, certainly, but it is a singular method of improving on nature's functions.

At the period of the eruption of the first teeth, the child first succeeds in performing the movements of mastication, and about the same time the salivary glands attain a higher development and exhibit a larger amount of se-
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tion. It appears then, as a direct consequence, that amylaceous food, in moderate quantity, and well soaked, will prove digestible.

After the molar teeth have made their appearance, in the third and fourth half-years of infantile life, a great change occurs. The salivary glands are developed, the muscles of the infantile stomach strengthened, its digestive powers increased; and about this time more solid food is well borne, and may be allowed. Not only may more solid food be given, but you should order it. Every organ must be exercised according to its development and power, and hence you would not only weaken the stomach by withholding proper stimulus to exertion, but also the consistency and health of the very teeth would be affected; for it is an established fact, that the teeth will more often remain normal with solid and dry than with liquid, soft, and boiled food. Vegetable food, especially, requires protracted mastication and a large amount of saliva. Those animals known by the name of ruminants spend the largest part of their life in mastication. Mastication and saliva have not so much influence upon animal food; carnivorous animals will not masticate their food slowly, but they tear it in pieces and swallow it at once, leaving all the work of digestion to the stomach, and the other digestive organs of the abdominal cavity. Thus, even children without teeth, and without the full development of their salivary glands, will digest animal food, especially extracts, soups, etc., if administered to them. For this very reason, be cautious in directing the nutrition of small children: such as have no teeth, or bad teeth, or toothache, ought to be kept on a very small amount of amylaceous food, if any; whereas animal food, which requires less saliva and less mastication, is better taken and more readily digested. As it is certain that the first years of life will usually decide on the future condition of the digestive organs, you perceive the necessity of being unusually careful at this period.

You will generally find that little attention is paid to the temporary teeth. Parents and physicians do not care much about them, because they are to be replaced by the permanent teeth. But when you consider that the permanent teeth will not appear before the seventh or eighth year of life, you perceive what injury can and will be done if the

milk-teeth are neglected. Their original condition does not generally depend on the attention of the physician, for they are formed during foetal life, and their nature is determined sometimes by hereditary influences. Healthy and robust parents, endowed with good constitutions and normal development of their osseous systems; a mother who has been well during pregnancy, and not suffered from any morbid predisposition; wholesome and appropriate food; a well ventilated residence—these are some of the conditions which influence the proper development of the teeth of the infant.

Great care should be exercised in feeding. Every adult will remove such remnants of food as are retained in the mouth, after meals, by either cleansing the mouth with water, or the tongue, etc. Not so with children. Whatever they have not swallowed will be retained in their mouths adhering to their tongues, cheeks, fauces or in the folds of the maxillæ; even the food which has been swallowed will be ejected, owing to the extreme readiness of vomiting observed in a large number of infants. These particles of food, farina, arrow-root, milk, etc., are very liable by the influence of the air passing the mouth, or with every respiration, to become sour; and then, by their acidity, to affect the crowns of the teeth. Again, you are aware that mothers and nurses, not among the poorer class of the population only, will, whenever a child is crying, either surfeit it with food, and thereby produce vomiting, or gastric catarrh with a superabundance of acid in the gastric secretion and the contents of the stomach, or what is equally reprehensible, put in its mouth a mass composed of cracker or bread, with water or milk, and sugar. Now, nothing has a greater tendency to become acid than sugar; even in the intestinal canal the transformation of sugar into lactic acid is a common and normal occurrence. It is not strange, then, that under the influence of ever changing air in respiration, and the renewed afflux of oxygen, the transformation of the sugar into acid should take place very rapidly. You know from what has been said that the crowns of the teeth are very easily influenced, and destroyed by any slight acid brought into contact with them, even by fruit of any description; you will, therefore, not be surprised to find that the teeth will be severely affected by the transfor-

mation of the sugar contained in these filthy compounds. Children of from two to three years of age, come under your observation daily in whom this bad custom, and nothing else, has been the cause of the decay of the milk-teeth; thus giving rise to disturbances of the general health, and toothache in early life. To discontinue their use, is absolutely necessary before the eruption of the first incisors, as it will be very difficult to do so afterwards. The reason of this is well explained by Spielberger, who emphatically denounces the bad practice alluded to. After the enamel is removed from the crown of the tooth, from the constant effect of the reproduced acid, and the exposed situation of the crown, the access of cold air, and the contact with other warm or cold beverages will produce intense pain. Even the sucking-bag itself will give rise to pain by becoming cold, and the child will cry until a new and warm one is supplied by the nurse, whose pity is excelled by nothing but her ignorance. She will remove the cold one, and dip it into a warm solution of sugar, or keep it in her own mouth, and again put it into the infant's mouth, and the child will now keep quiet, sucking, and sleeping, and will also allow the nurse to sleep. You will meet with infants sometimes, who are perfectly incapable of sleeping without this substance between their lips, from the mere fact that the enamel of their teeth is removed, and the ivory half gone, and the infant feels pain from having no protection against the cooling influence of the air. Thus the teeth are destroyed until the pulp, too, is affected, when the child will feel no longer any pain. It has no pain, and no teeth. A tooth will sometimes be eaten away in this manner before the crown is fully developed. You will meet with a large number of children, who, from one or more of the reasons alluded to, have no healthy incisors, or perhaps, no incisors at all, from their second or third year, up to their seventh or eighth.

As the incisor teeth have no other office but to rend or cut the food, digestion itself will sometimes not suffer much, provided the child masticates well otherwise, mixes the food with a sufficient quantity of saliva, and has a perfect and undisturbed gastric and intestinal digestion, *on the condition* that the knife, before the food is brought over the lips, does the work of the incisor teeth, as much as artificial

means can do. But a serious consequence, alluded to by a number of physiologists and lately by the above-mentioned author, must not be overlooked. You know that a number of letters, as D, T, and even S, C, St, etc., are formed by the tongue approaching the top of the incisors. But what if they are absent? The child will try to pronounce as well as circumstances will permit; thus those consonants are formed by the tongue touching the alveolar margin of the jaw-bone, and pronunciation becomes unclear, thick, and lisping. This misfortune is not at all mended by the temporary teeth being replaced by the permanent ones, about the age of seven or eight years; for the child has been accustomed to bring forward its tongue in pronouncing the consonants D, T, S, C, etc., to the alveolar process, and scarcely ever will this custom be replaced by the better one of again accustoming the tongue to touch the top of the incisor teeth. No muscles are more obstinate, when once used to one particular action and motion, than those of the tongue. This is seen in the attempt to pronounce a foreign language. There are few men who are able to pronounce certain words of a foreign language as well as those of their vernacular; and it is a fact, that, from mere physical reasons, a young person will learn the pronunciation of a foreign language more easily than adults, whose lingual muscles have been active for decennia in the same manner and direction, and with the same exertion. Thus there are, therefore, reasons for carefully preserving the milk teeth in young children, other than merely for the sake of beauty, or digestion, or comfort. If they are destroyed, if tooth-ache is produced, or other inconveniences result, you will naturally think of extraction of such a tooth. In my second lecture I alluded to the fact, that after the extraction of a tooth, the jaw-bone becomes atrophied, the alveolar margins more narrow, thinner, and lower, and that in the extraction of a temporary tooth this danger is greatest; for at a later period of life, the permanent one will not meet with sufficient space. Moreover, the molar teeth, at the age of four or five years, have long and deep roots, whereby extraction is rendered very painful. It must be borne in mind, also, that the pulp of the permanent tooth is, about this time, imbedded between the roots of the temporary one, and you may, by forcibly extracting the one, deprive

the child of the other at the same time. Again, a hard cicatrix will be formed by extraction, and the permanent tooth may cut through it with difficulty. The child has also suffered a severe loss, being deprived of one of its instruments for mastication. If you can preserve the tooth it is your duty to do so, while in cases of carious molar teeth in children, it is better to have them filled than extracted. My remarks refer to the normal condition of the teeth and gums. But the tooth must be removed in cases of dental caries, where an inflammation of the inner alveolar membrane, and sometimes suppuration, takes place—a morbid process, which is, in a number of cases, complicated with swelling of the submaxillary glands. These tumors are commonly considered scrofulous, but when they are the only symptoms of "scrofula" which you can detect a child, never forget to examine the state of the jaw and the teeth, and search carefully for a deep-seated, painful inflammation and suppuration around the root of a tooth.

LECTURE IV.

Formation, Nutrition, and Protrusion of Permanent Teeth.—Absorption and Expulsion of the Temporary.—Their Causes.—Period of Second Dentition.—Wisdom Tooth.—Third Dentition.—Curious Cases from Literature.—Is there a Third Dentition?—Explanation of the Cases on Record.

GENTLEMEN:—In order to complete the anatomical and physiological part of our subject, let me proceed to some remarks on the permanent teeth. You remember, from my previous lecture, what I said, following the description of the process as given by Harrison, on the first formation and development of the temporary ones. Soon after the commencement of the saccular stage of the deciduous teeth, the rudiments of the second or permanent set are developed. About the fourteenth week of foetal life the deep portion of the primitive dental groove is closed in, and contains the sac and papillæ of the ten milk teeth; the upper or superficial portion of the groove remains open, and is then named *secondary dental groove*. In this commence the rudiments of the permanent teeth. At first a small depression is observable behind the superior openings of the milk sacs; this increases, and forms the *cavity of reserve*. These cavities are lined by an inflection of the mucous membrane, and at the bottom of each a small papilla is formed; they gradually recede from the surface, and are thereby converted into follicles, and finally into closed sacs, which lie to the inner side of, and in close contact with, the former set, and inclosed in the same submucous tissue. The necks of these sacs, by which they originally communicated with the general mucous membrane, continue as obliterated cords leading to the surface of the gum, internal to the deciduous teeth. These cords have been named the *gubernacula*, or *itinera dentium*, roads of the teeth, without having, however, any such office as the name would appear to imply. The primitive dental groove, behind the posterior deciduous molar, does not close so soon as the anterior portion, and in it are developed about the fifth month of foetal life the follicle and papilla of the anterior permanent molar. After

its follicle has closed, the dental groove closes over it, leaving a space between the gum and the sac of this tooth; in this is a cavity of reserve of mucous membrane for the second permanent molar, and one also for the third molar or wisdom tooth. As the deciduous sacs, as well as the anterior permanent ones, increase in size more rapidly than the bones can elongate, this cavity for the permanent molars is pressed backwards into the maxillary tuberosity above, and into the root of the coronoid process below; but in a few months after birth, as the jaws increase in size and length, the first permanent molar returns to its proper level in the dental range; the cavity of reserve behind them dilates into the space the first molar occupied, and in it is developed the papilla for the second permanent molar. In the course of time, as the jaws further elongate, this tooth advances and descends, and the remainder of the cavity of reserve dilates behind for the third permanent molar or wisdom tooth.

The permanent sacs at first receive their vessels from those of the gum, but afterwards from the temporary sacs; and as they retire into their own cells, these new vessels enter into new dental canals, which become permanent. In the course of a few years, and after all the temporary teeth have appeared, the further elongation of the jaws admits of space for the first true molar to protrude; this usually occurs between the sixth and eighth years, and sometimes even sooner. At this age there are fifty-two teeth in the two jawbones, viz. twenty deciduous teeth, twenty permanent beneath these, and the twelve posterior molars; and when all the anterior permanent teeth have become enlarged they press upon the anterior wall of their alveoli, which soon undergo absorption; and then each tooth comes a little forwards into the lower part of the alveolus of the milk tooth; the fangs of the latter are absorbed and gradually wholly removed, and then the crown falls out of the sac and the permanent tooth supplies its place. The cause of the disappearance of the roots of the temporary teeth is sought for in the loss of nutrition from the pressure of the *subjacent* permanent tooth, and perhaps in contemporaneous increase in the general injection and nutrition, bringing on liquefaction and absorption. Some pressure is necessary, at all events, for whenever there is no pressure from below, the

temporary tooth is not removed. But you must not imagine that the permanent tooth exercises any immediate pressure on the blood-vessels, thereby depriving the temporary tooth of its nutrition; if this was the case, the permanent tooth would exercise just the same influence at a much earlier period, even while the temporary itself was not fully developed. The crowns of the permanent molar teeth, further, are perfectly unable to exercise any pressure on the blood-vessels of the temporary, as they are situated between their roots. The nutrition of the temporary teeth is impaired by two facts, first by the increasing development of the permanent themselves, and further by the development of the maxillary bones, which contract and partially obstruct the canals through which the branches of the maxillary artery penetrate to the tooth. The pressure of the permanent tooth on the temporary one is not at all direct; nor is it necessary that it should be so. Nature usually, in building up and destroying, works very slowly and invisibly. A fine instance of what a slight pressure for a protracted period may effect, and how bones are absorbed from the pressure of a slight physical influence, is given in the fact, that aneurisms of large arteries at some parts of the body, where they are in the neighborhood of bones, destroy the bone by slow gradual absorption. Thus aneurisms of the aorta are reported to have produced absorption of part of some spinal vertebrae, and I have myself seen two or three costal cartilages absorbed from the constant hammering against the chest by a large aneurism of the ascending aorta. You see, therefore, that the pressure of the permanent tooth inclosed in its cell, on the wall separating it from the temporary tooth, it being slowly and continually forced upwards, may be deemed sufficient to bring the root of the temporary tooth to absorption. The effect of the permanent teeth is not in one direction only, for you know that the permanent teeth are not situated in the same horizontal line; the steady slow pressure is exercised upwards and laterally, thus the roots of the molar teeth are absorbed on their inner sides; and the middle permanent incisors press not only on the corresponding temporary, but the lateral ones also. The root of the temporary tooth, while being deprived of its normal nutrition by pressure exercised on the periosteum, is liquefied by the

increased action in the surrounding parts, brought under the influence of the numerous absorbent vessels contained in the sac of the onwards growing tooth, and excreted like so many other effete matters. The vessels rendering this service to the organism, have been made the subject of particular study by Boardet, who called them "appareil dissolvant," and Delabarre, that learned humbug and nostrum-seller, who comprehends them under the name of "appareil absorbant." This absorption can take place as long as the root is in some connexion with the surrounding parts. If it ceases to be so, the vital powers of absorption are replaced by another; in this case the root has the general effect of a foreign body brought by some means or other into contact with and imbedded in the organism, to produce inflammation and to be removed by suppuration. Thus no resorption takes place even when the crown of the permanent tooth comes into immediate contact with the root of the temporary; in which cases the temporary teeth, particularly the molar, are found to be turned over and produce, by the effect of their sharp roots, deep ulcerations in the cheek, which will not heal before the temporary tooth is removed.

The permanent teeth appear no more nor less at regular periods than the temporary ones. About the seventh year, or earlier as I mentioned before, the first permanent molar appears, nearly about the time when the first temporary incisors are replaced by the permanent. After all the incisors are changed, the anterior and posterior temporary molars are successively shed and replaced by the permanent bicuspides; the canines are changed about the tenth or eleventh year. About the twelfth or thirteenth the second permanent molars appear; the last molars, or wisdom teeth, usually some time between the twentieth and thirtieth.

Ossification requires but a short time in the deciduous teeth, and longer in the permanent. A permanent incisor requires seven years, a canine twelve, a molar from eight to ten years. Ossification commences at the very same time in incisors and the first molars, as is proved by the dissection of the jawbones of infants who died in the first months after birth. It progresses more rapidly in the female than in the male sex; girls, therefore, have their permanent teeth sooner than boys.

In the lower jaw of a child three years of age, the permanent teeth are still in an oblique direction. Only the middle incisors, which are the highest, are in a nearly vertical position; the lateral incisors are situated more inwards, and more obliquely; the lowest are the canine teeth. Higher, and between the roots, we find the molar teeth in their first stages of development, or rather the first one; for as to the second, we find nothing but the cells in which it will be contained in future. The time of its first formation is about the fifth year. As it requires about eight years for its complete ossification, it makes its appearance about the thirteenth year of life. The commencement of ossification in the third molar tooth, and particularly its appearance, is more uncertain, as it depends on local circumstances. It does not usually appear before the twentieth year, but in some cases, according to C. Harris, does not show itself, until the thirtieth or even fortieth year, and Canton extracted one for a gentleman seventy-four years of age, who informed him that it was not out until he had attained his seventieth year.

The maxillary bones of a child of from four to five years contain so many and so large cells for both the temporary and permanent teeth, that but very thin osseous walls form bridges between the external and internal wall of the jawbones. Nevertheless, every tooth, both temporary and permanent, receives a ramification from the common maxillary blood-vessels and nerve. There is sometimes, according to Delabarre's observation, an anomaly in the lower jaw, of this sort, that the submaxillary artery and nerve, right at their entrance into the lower maxilla, divide into two branches, one of which feeds the temporary, the other the permanent teeth. The periosteum of the alveolar cell, being a mere continuation of the external periosteum, takes its blood-vessels from the maxillary artery, branches of which penetrate the porous osseous substance.

A very interesting subject relating to our investigations is that of the so-called third dentition. Is there at all a third dentition? Are those teeth which we are used to call permanent, not permanent, but subject to be temporary only in proportion to those which are to be as it were more permanent? Certainly there are a number of cases reported, in which the teeth are said to have fallen out twice,

and to be replaced twice. There is one case even of the following description:—In a girl the first replacement, or second dentition, took place at six years, the third dentition at twelve; this latter was complete in a single year. This case, our author says, "is highly interesting for two reasons, first, because it occurred in a young individual, while cases of third dentition have been hitherto related of old people only; second, because all the teeth were replaced here by others, while the third dentition has always been incomplete, and limited to the appearance of two or three teeth only." The case, gentlemen, looks so very interesting and beautiful, that I am afraid the reporter is greatly mistaken, or has been grossly imposed upon. Other cases of third dentition are reported, but scarcely any of such a remarkable kind as this one. At all events we require a good deal of belief in the veracity or the judgment of a writer, if we are to take as scientific facts such reports as are in open conflict with the known laws of anatomy and physiology. W. Jackson has the cases of a man of sixty-four, and of a woman of eighty years, in whom a third set of incisors was observed; in one of them the old teeth had just fallen out to make room for the new ones. Sorgoni reports the case of a boy exhibiting a third dentition before he was twelve years of age, and Andral has collected from literature twelve cases of the same anomaly. Lison reports the case of a boy, Eugene Cavillan, thirteen years old, of young and healthy parents, of good constitution, and well, and without any anomaly in his general development. The second dentition took place when he was nine years old. Soon after, all his twenty-eight teeth were replaced by others; the same occurrence took place between his tenth and eleventh year, and again between the eleventh and twelfth. When the case was reported by the author, the boy was said to be in his thirteenth year; at this age a new set of teeth was being developed; the first inferior molar tooth of the right side fell out, to give way to another that was already visible. The teeth that had fallen out had no roots, which appeared to be eroded. The removal and replacement always took place in the usual order, the teeth being small, white, and of normal shape and position. The gums were red and somewhat tumefied, and the general health of the boy satisfactory.

I consider it a characteristic occurrence that curiosities like those alluded to are more numerous in old, very old books, than in modern ones. Storch, alias Pelargus, who wrote in 1750, reports the case of a lady of seventy years, who, after having lost all her teeth for a number of years, had a new incisor at that advanced age. He further has the case of his own daughter, who cut five molar teeth in her twentieth year; lost them all, and had new ones in their place when she was thirty-eight years old. Before this time, our author says, the lady was always sick from this abnormal teething—the symptoms enumerated, however, being evidently of uterine and hysterical nature; but after the last teeth cut, she became healthy, and strong, and fat. Old Paulinus relates the case of a Countess of Detmond, who lived up to a third dentition, in 1589, and grew one hundred and forty years old. The younger Pliny has the observation of the last molar tooth appearing at eighty years of life: Schottus at forty years, in a physician of his acquaintance; Cardanus, the celebrated mathematician and inventor of the Cardanian Formula, is reported to have cut a tooth at forty-three; several soldiers at forty-three, forty-four, and forty-five; several others, according to Senner-tus, at sixty-three, seventy-five, eighty, eighty-one, eighty-eight, even at one hundred and four years of age. In an old book of 1725, there is the case of a woman of sixty-six years, who got not only new teeth, but new brown hair, instead of her former grey. Johannes G. Slevogt reports, in 1733, the case of a captain who cut new teeth at ninety-four years of age, and died soon afterwards; we do not learn whether the old man died in consequence of teething, or whether, if he had not teethed again, he would not perhaps have lived up to our times, and been still older than ninety-four. But the greatest curiosity I have ever been able to hunt up is the following, reported by Möllenbroc, a century and a half ago. There lived at Leipsic a noble lady who had five children; with every confinement she cut a molar tooth. As soon as one of her new teeth got loose, the child who was born at the time when it was cut, was affected with some severe disease. If such a tooth fell out, she was always certain that the corresponding child was surely going to die. And so it happened, adds our honest author; all the five children died



advanced period of life. It is not a very rare occurrence that the temporary second molar tooth remains at its place up to the fortieth year, and thus there can be no mystery nor wonder about the fact that another tooth will make its appearance afterwards.

The temporary second molar tooth, however, is not the only one that will remain for a long period, and thereby retard the second dentition. Linderer reports the case of a girl who had her first permanent molar tooth with her eighth year, but whose second dentition did not begin before the fifteenth year. Another healthy and robust girl of fourteen years, who never had the four upper incisors, had all her other milk teeth, yet without there being any probability of an approaching change. Murat has the case of a robust young man of seventeen, who had all his milk-teeth but five; and Bird and Maingault report similar cases. Other cases are noticed, by Linderer, of single milk teeth remaining up to the thirtieth or fortieth year; and Riecken gives the history of a man of eighty-five, who cut a number of incisors and molars, and is said to have suffered during his cutting a molar in his left lower jaw, from cerebral congestion, which was relieved, after local depletion had no effect whatever, by spontaneous hemorrhage from the inner angle of the eye. Finally, a woman of forty-three years who had all her milk teeth left, was observed by Duntzer. After she had been suffering from intense pain in her head and upper jaws, from swellings of the gums, and diarrhoea, four teeth protruded behind the upper incisors; they were smaller and sharper, and troubled the functions of both mastication and articulation. After the lapse of a year, the same symptoms were observed in the right lower maxilla, which never had any molars before.

Kneisel reports the case of a lady who reproduced four inferior incisors in her fifty-fourth year, after having worn artificial teeth for some time; and a right upper incisor, in place of one that had just fallen out, two years afterwards. The teeth which had fallen out were undoubtedly the temporary ones that had never been removed, and finally fell out at an advanced age from being either pressed upwards mechanically, or being decayed; nobody can say which, as the report does not contain anything beyond the facts I have related. Professor Nessel has the case of a lady

who cut a fine white canine tooth at fifty years of age. This tooth became more visible from year to year, not because of its growth, but because of the decrease of the alveolar margins of the maxillary bone. It had been, in his opinion, always formed and ready to protrude, and would have done so but for the other teeth occupying the space naturally designed for it. The same author reports in his book on dentistry (1856) the case of a gentleman of thirty years, who still had his temporary upper incisors.

LECTURE V.

Is Dentition a Disease or a Cause of Diseases, in itself?—Opinions in Ancient Times.—In the Middle Ages.—Names of Men who early Denied both Assumptions.—Local Irritation considered as the Cause of the Diseases supposed to be the Direct Effect of Dentition.—Nature, Locality, and Action of this supposed Irritation, in the Opinions of the Authors.—Subjective Symptoms of Normal Dentition: General and Local Irritation.—Objective Symptoms: Swelling of the Gums, disappearance of the Dental Cartilage, Salivation, etc.—Local Diseases attending Dentition: Odontalgia, Gingivitis, Odontitis.

THE belief that the formation and protrusion of teeth are morbid processes, or give rise by their own nature to a large number of diseases, is by no means so old as we are apt to suppose from the general prevailing opinion. Old Hippocrates has a few remarks on the subject, but he cannot, from the few words that are found in his works, be presumed to have cherished the opinions of more modern doctors. For his remarks are, that "In those children who have proceeded to the age in which they get teeth ($\pi\zetaος \delta\epsilon το οδοντωφυειν προς αγονων$), there will occur a disagreeable itching in the gums, fever, convulsions, and diarrhoea, particularly at the time in which the canine teeth will protrude, and in such children as are very fat and suffer from costiveness." And he further states as his experience, that, "such as have diarrhoea during dentition, will suffer less from convulsions than such as are costive. Such as suffer severely from fever, will be less affected with convulsions than those who keep their flesh and weight, and feel inclined to sleep. Such as get their teeth in the course of the winter, are better off under equal circumstances. Not all those who have convulsions during dentition, will die, but a number will be saved. Those who have a cough during dentition, require a long time before they are through, and will emaciate more considerably. Those whose teeth will protrude in the winter, suffer less than others." Nor has Celsus any remarks showing that he considered the process of dentition a disease or a cause of diseases; Galen only, in his commentations on the aphorisms of Hippo-

pocrates, thinks proper to state that diseases may be the result of the irritation produced in the gums by the protruded teeth. This theory has prevailed in the middle ages, both among the profession and the public of all countries, not from its being proved, but only because it was not examined; or rather because medical science and natural philosophy made no progress, or very little indeed, for more than fifteen centuries after the death of Galen and Aristotle. There is, however, a remark in the work of Mercurialis on the diseases of children (1584), which shows that the minds of eminent men will not always be clouded by prejudices though old and general. He states, that he cannot help having some doubts, although he feels some hesitation in pronouncing them, as to how dentition could be a disease; as it certainly is as clear to comprehend that nature does not intend nor willingly create disease; and dentition is a "mere work of nature, that is to say, a physiological process, and for this reason, must not be called a disease." And Heister, in 1753, has the following: "When symptoms, like pain, crying, sleeplessness, fever, convulsions, and epilepsy, occur, it is sometimes really difficult to learn where they come from, and from what cause, as they will depend on a variety of causes. Therefore all such symptoms must be weighed in your mind with the utmost sagacity, until you are able to say, for certain or with every degree of probability, whether they arise from bad milk or from other causes."

There are some names in literature, which ought to have the full credit for their endeavors to enlighten the profession on the nature of dentition and its pathological importance or unimportance. I would here mention the names of Wichmann, Sternberg, and Buchheim, and also Bresfeld. But in order to understand, against which and how many prejudices they had to battle, it will be necessary to state some of the opinions spread amongst the profession, in whose minds there was no doubt that the irritation produced by the protrusion of teeth gave rise to diseases. The profession only differed as to the explanation of the locality, nature, and mode of acting of this irritation, and you will find some amusement in comparing different opinions.

One would assume that there were a large number of nerves in the gums, and an extraordinary irritability result-

ing therefrom. Another, and an illustrious man too, would take it for granted that a layer of osseous matter, covered moreover with periosteum, would prevent the tooth from protruding from its cavity. The osseous layer was, besides, asserted not to adjoin tightly the circumference of the protruding tooth, which would permit air to enter and irritate the poor dental nerve. In the opinion of others the general irritation in dentition would be the result of the pressure of tooth and alveolus on each other, which is less comprehensive to common sense than any other explanation. Others again presumed that the gums, while retaining the tooth in or repelling it into the alveolar cavity, would exert a pressure on the nerve. One says, incisors give rise to a large number of casualties because they are so sharp and pointed; another, that the protrusion of incisors causes but a small number of casualties *because* they are so sharp and pointed. A third again says, diseases during the protrusion of the incisors are very frequent because some of these and the first molars cut at the same period in which the system is still very feeble and the gum very irritable; a fourth, that they are rarer than at the time of the protrusion of the molars and canines, because the gums are softer and all the fibres more tender. One declares that the protrusion of the incisors is not so dangerous because their point is sharp; the other, that the canine teeth are very troublesome; because again, their point is sharp; and a third, because it is not *quite* sharp. The same canine teeth prove very dangerous, in the opinion of one, because they grow very slowly, of another, because they protrude so fast; faster than the molar teeth, which cut with a broader surface but more slowly and gradually. At last another comes telling you, that molar teeth are very dangerous, because of this very broad surface penetrating the gum. But more dangerous than any of the molars or incisors are the canine, in the opinion of another busy expounder, because in its protrusion it is hemmed in by an incisor on one, and a molar tooth on the other side. There comes, then, a profound anatomist who discovers that there are folds along the upper margin of the gum which, when normally developed, will prevent any disorders and serious diseases; but the norm appears to be that their development is thoroughly abnormal—and that diseases during

and in consequence of dentition are commonly found. A neuropathologist considers a cutaneous spasm to be the common cause of all the troubles; another denies the sensibility of the gums, but thinks proper to attribute to it a large amount of irritability. A follower of humoral pathology seeks for the cause of all the evils in the increased quantity and poisonous condition of the saliva, another in the suppression of the secretion of the salivary glands; a third, and one of the best names too, Hufeland, in the fever which is said to be absolutely required for the regular and normal progress of dentition. And at last a celebrated author also goes so far as to deny the existence of local influences in the gums to produce general diseases, but attributes them to the fact that during the protracted period in which teeth protrude, the general development of a large number of organs takes place contemporaneously, and that dentition disturbs its regular progress.

These and other opinions have been expressed, and warmly defended, as the origin of all those numerous, or rather numberless diseases of dentition. Buchheim, in an elaborate article published forty years ago, has, by ransacking the literature of the last and the first twenty years of this century, collected these and more theories of a similar kind, and exhibited an unusually interesting picture of contradictions and arbitrary assertions. I have abstained from giving the names of the authors of such theories as have been brought before you; but I have thought it just as well done to omit them, not considering these theories to entitle their inventors to immortality. Such as have no other claim to immortal fame, will soon be forgotten, and some of them have been forgotten already with the single exception of their names.

I was just about closing up the exhibition of these more or less queer, comic, or astonishing opinions concerning the cause of the numerous supposed diseases of dentition, when I remembered the great physiologist, pathologist, and public benefactor, M. Delabarre, of Paris. He has at last dissolved the gordian knot of that much tormented question all at once. What of inflammation of the pulp? he exclaims, what of compression of the periosteum, injured nerves, tension and rupture of the gums, and all other assumed causes of the diseases of dentition? Why is it,

he asks triumphantly, that one sixth of all the deaths in infantile age occur from dentition? I have found it! Do you not see that before and during the protrusion of teeth the child brings its fingers to the gums? Would a child do so when or because it has pain in the gums? Certainly not; for if it had pain it would carefully avoid touching and pressure. Therefore, "*que serait-ce, sinon une sensation de prurit, de denangeaison, de chatouillement?*" What could it be, pain being out of the question, that induces the child to bring its fingers to its mouth? Why, a sensation of pruritus, or tickling. Now this pruritus of dentition will not be found, or not considerably, in normal cases of dentition; but in children with bad nutrition it is perfectly intolerable, and gives rise to the perturbation of all vital functions, sleeplessness, loss of appetite, dyspepsia, fever, diarrhoea, vomiting, and convulsions. Nor does the author of this ingenious theory pretend to say that all the children are equally subject to this dentition pruritus. Not at all. Those suffer most who are most ticklish.

If, perhaps, you cannot understand the logic of these assertions, their author will probably consider you incompetent. He may be right, as long as you do not know all the attending circumstances. The reason why this theory was invented is this, that M. Delabarre invented at the same time his dentition syrup, which is determined to cure the dentition pruritus, and thus to save a million of infants a year. It is but just to say that M. Delabarre knows more of this syrup than anybody else, as he has taken particular pains not to divulge its composition, but to prepare and sell it himself. Thus you have the wonderful sight of the powerful mind of a single ingenious man discovering two important things contemporaneously; viz. a morbid condition, or a disease, which is the cause of a legion of others, and besides, the infallible remedy. Which of the two he has discovered, or invented, first, "*deponent saith not.*"

That a large number of infants cut their teeth without any bad symptoms, has never been denied. Instead, however, of considering these cases as natural, they have been taken as exceptions; instead of looking for the causes of diseases in the age of the patient, and its various morbid dispositions in its constitution, or in direct injuries, both authors and the public have seemed to rest satisfied in the belief that the

more an infant was disturbed with abnormal functions, the nearer came dentition to its natural standard. But all the symptoms observed during or before the protrusion of teeth do not come within the range of morbid affections; I have already spoken of some of the symptoms indicating the approximation of, or attending, the progress of dentition; I therefore shall not dwell upon them, but shall briefly enumerate such as are generally attributed to the protrusion of teeth. I may state that many explanations which would be here required, will naturally follow a physiological sketch of early infantile age, which I intend to give you in a future lecture.

The general irritability of the nervous system in teething children, is said to be increased. They are restless, sleepless, will suddenly awake from a short slumber, are peevish and cross, change their color frequently, and often urinate. I am certainly unwilling to deny the frequent occurrence of these symptoms in teething infants, but will take the liberty of stating, that in early infancy nervous symptoms are of frequent occurrence; that even the weight of the organs of the nervous system is greater in proportion than at any other period of human life, and its action may be supposed to be more powerful, and perhaps irregular; and that the very same symptoms attributed to teething are really being observed in almost all the affections occurring at this age. Both functional disorders and diseases are the more frequent the younger the individual; this is a fact clearly shown by all the statistics of both private and hospital practice, relating to both diseases, and the rate of mortality in this early period of life.

The local irritability produced by the process of dentition has often been noticed, and alluded to as a proof that there is something very peculiar and troublesome about this process. The infant is said to put its fingers into its mouth, and introduce anything it can lay hold on; it bites the nipples, and gentle rubbing of the gums causes an agreeable sensation. It is said to rub its lips, nose, and eyes, and to move the occiput on the pillow, especially at the time of the protrusion of the incisors of the upper jaw.

Such are said to be the local symptoms of either approaching or present dentition; the latter term always being made use of to signify the final protrusion of the teeth. Is

it remarkable that an infant will put its fingers into the mouth at this protracted period of teething, viz. from the fifth or sixth to the thirtieth month, when it has done so from birth? The very fact of the peculiar position of the foetus in the uterus, the prominence of the action of the flexor over the extensor muscles, appear to be among the first causes of the new-born child's sucking its fingers. The great sensibility of the cutaneous nerves of the ends of the fingers, and of the lips, which are moreover regularly exercised by the reception of food; the indistinct impression, in the infant, after having been nursed a number of times, of the lips and mouth being in some connexion with the feeling of satisfaction, are the reasons why the infant sucks its fingers in the few weeks and months following its birth. Whichever explanation is correct, it is a fact that, from the hour of birth the infant will either suck its fingers or keep them in the neighborhood of the mouth and nose. Nor is it astonishing that an infant will, during the time of dentition, take everything to its lips and into its mouth, after it has done so all its life. The principal impressions an infant obtains depends on its relation to foods and drinks; eating is the only real propensity an infant has, and the mouth is known by experience to be the great receptacle destined for the reception of everything around; not to speak again of the lips being used as a means of touching, grasping, and learning the qualities of things. Everything living learns by experience and experiments, by physical impressions. All the sensory organs will be exercised for the purpose of understanding the impressions on the peripheral nerves, and the sensory organ first freely exercised by an infant is that of palpation. Further, a teething child will often bite the nipple, undoubtedly, but a number will not; and any child with any irritation of the cavity of the mouth, with any form of stomatitis, with any disease in fact which causes a sensation of uneasiness, will do the same. And finally, ought we to attribute the restless movements of the occiput on the pillow to teething, when every child affected with almost any affection of the brain, or its membranes, with hyperæmia of the cranial bones, with cutaneous eruptions of the cranial integuments, and rachitical affection of the bones, will be observed to do the same? Why is it that the protrusion of the upper

incisors is often attended with this restlessness, and almost regular moving to and fro of the head on the pillow? It means, that irregularity, or anomalies in the protrusion of the upper teeth frequently depend on anomalous development of the upper jaw itself; and that the development of the upper jaw is generally in intimate connexion with the development of the cranial bones. Thus you perceive, that when this is abnormal, and the upper jaw suffering accordingly in its general development, that often-mentioned symptom has nothing to do with the protrusion of teeth, as such, but must be referred to a defective or abnormal development of the cranial bones and subsequent anomalies in the structure or function of the brain. Instead, therefore, of pointing to dentition, especially to normal dentition, it indicates some more or less grave disturbance in the constitution or function of either the brain or its membranes, or its cranial or cutaneous integuments.

There are some objective symptoms announcing the approaching protrusion of teeth, which are of more or less importance. The gums will swell, and become looser and softer; or, which is more common, the alveolar margin will become thick, hard, flat, and prominent. This condition is always perceptible, and nevertheless we are liable to be mistaken as to its signification. I have seen a child, who had this prominence of the thickened alveolar margin over several teeth for a long time, without the teeth making their appearance. In fact, deep incisions had been made into the gum, more than two months before the first incisor cut through. This shows that although the normal process of dentition generally requires the condition of the alveolar margin described above, we are by no means justified in predicting a speedy protrusion of a tooth through the thickened and elevated wall. This prominence of the so-called dental cartilage is often said to be red, livid, and soft. But in healthy infants, and with normal dentition, the contrary is generally the case. The mucous membrane of the mouth, although normal, is generally of a deeper color than the exception perhaps of constipation. But the restlessness of the infant was in connexion with this constipation, and it screamed from colic pains? Although we are told by observers that the symptoms would disappear with the protrusion of the very first point of a tooth, the number of

cases of this dental disease is so small, that we cannot refrain from doubting the correctness of the diagnosis. In olden times, odontalgia from dentition has been observed a number of times; thus Karl Himly has a chapter on the subject; but a more modern author, Hanmann, relates having seen two cases occurring during the protrusion of the molar teeth. Two cases in the lifetime of a medical man, who has met with many thousands of teething children; no pathognomonic symptoms in these very cases to distinguish them from other complaints; no like observations in the practice of hundreds of other practitioners—all this looks rather suspicious, and leads us to infer, that this odontalgia depending on dentition, although its occasional occurrence during the protrusion of a tooth may have been observed, is rather doubtful.

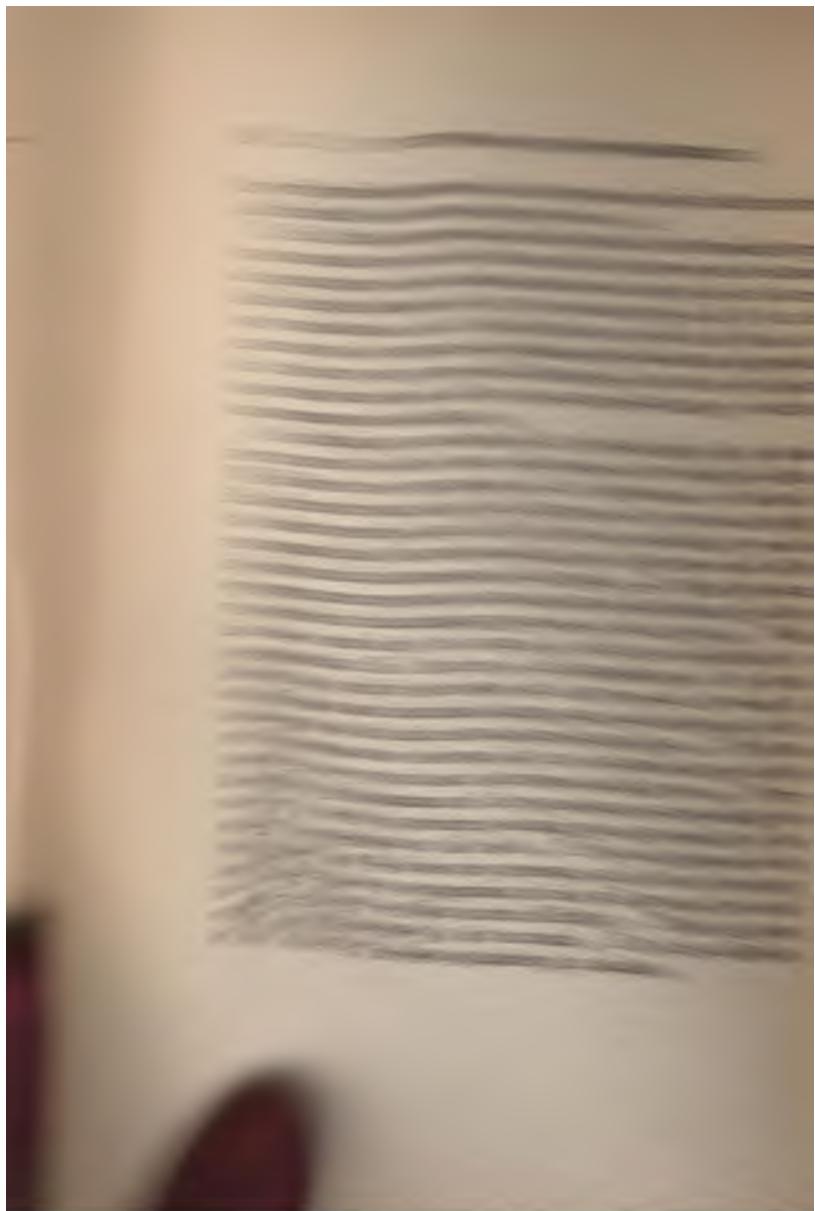
Gingivitis, inflammation of the gums, is also reported to have been observed in the course of dentition. Its symptoms are the very same that have been given as premonitory of normal dentition, and in odontalgia, with the addition of intense injection, swelling, and heat of the gums and the mucous membrane of the mouth and pharynx. We are justified in doubting whether all these cases have been primary gingivitis, or whether or not the affections of the mouth and pharynx have been the primary diseases; the more so when we again are told of the presence of the very same symptoms as above, and moreover learn, that the gums will not only tolerate a moderate pressure while inflamed, but the patient feels relieved. That there can be a severe inflammation of the gums, in connexion with the protrusion of a tooth, is proved by the difficulty sometimes, though rarely, met with by the protruding wisdom tooth, resulting from insufficient room, etc., but very rare it must be, as the termination in suppuration has been observed by but very few men, and but very seldom altogether. We are the more justified in so presuming, as we know of a number of cases of very severe and general stomatitis without the least affection of the gums, and of others where the gums were immensely swelled without injection, heat, or pain; and as the gums are generally very little apt to be affected by inflammatory action. Ulcerations of the cheeks in the immediate neighborhood, or even anomalous protrusion of teeth, either deciduous or

permanent, through the gums and alveolar process, in an oblique direction, are but seldom found to give rise to an inflammatory process in the gums.

Odontitis, or inflammation of the tooth, is the third local affection sometimes attributed to dentition. Again the same symptoms, pain, injection, swelling, are enumerated, and described as very intense and obstinate. Recovery would not always take place, although it would be the result, after days or weeks, in the majority of cases; but death would sometimes ensue under the symptoms of a thorough affection of the nervous system, or of a "typhoid fever." It would often be combined with other diseases, and, according to Schölein, not unfrequently with rhachitis. Jahn has made a number of *post-mortem* examinations in cases of odontitis, and what did he find in such children who died from inflammation of a tooth? Why, hyperaemia of the brain, acute hydrocephalus, "gastromalacia," and always violent inflammation of the gums and alveoli, with sometimes a dark bluish color of the alveolar margin. This latter shows certainly injection, but the former prove those children to have suffered from, and died of cerebral diseases. The connexion of rhachitis also points to the slight importance of the local affection, showing that the principal danger has been observed to be derived from constitutional or local ailments, not at all depending on, or connected with, the local process of the protrusion of a tooth. I have to state, finally, that there is no such thing as odontitis proper, the dental tissue being too hard and deprived of normal appearance of the gums, and frequently, in catarrhal affections of the mucous membrane of the mouth, the difference between its livid and softened velvet-like appearance, and the pale color and solid condition of the gums, is remarkable. Only when the protrusion of a tooth is very imminent, the gum will be in many cases a little sensitive, on being touched or pressed; and saliva and mucus are said to be secreted in a large quantity at the same time, until the gums become thinner and thinner, and the tooth protrudes.

Great importance is attached to salivation by the public, as a premonitory symptom of dentition; but it is a fact, that it will sometimes precede the breaking through of a tooth for a number of months, and will not cease after the

tooth, or a group of teeth, have made their appearance. It is thought to be caused by the direct irritation of the gums, acting on the mucous membrane of the mouth, and the stenonian etc. ducts, and the salivary glands. It has even been considered to be the cause of a number of accidents occurring during dentition; the saliva and mucus were, in the opinion of a number of medical writers, swallowed, and proved to be the cause of vomiting and diarrhoea, of erosions and aphthous inflammation of the mucous membrane. The truth is, that increased salivation is regularly observed in infantile age, long before, and during the first period of dentition. If, therefore, those authors were right, who believe it to depend on the irritation of the mucous membrane of the mouth, and of the salivary glands, there must be a constant irritation of the gums in every normal dentition. This, however, is not so, according to my preceding remarks. I will simply state now, that the increased secretion of mucus and saliva before this time does not depend on the protruding teeth, but is the result of the salivary glands and mucous follicles undergoing about this time a rapid process of development. We shall have to return to this subject, and have to learn from a physiological sketch of the infantile organism, which I expect to give in this course of lectures, that a number of symptoms apparently affected by each other, and depending on each other, are but co-ordinate consequences of one and the same common cause. At all events this will be readily understood by you, that the increased salivation need not be produced by some supposed constant irritation of the gums. At all events, you will not be deceived by the occasional emphatic statement of another observation, which is meant to show that dentition in normal and robust children will be attended with copious salivation, while sickly and feeble children have no salivation to any amount. This appears to be true, but is not. The observation is imperfect in this, that healthy and robust children of four, six, or eight months, will generally, while awake, be in an upright position, thus dropping a large amount of the secreted mucus and saliva, and being constantly wet with it; while sickly and feeble children of the same age, will, first, be a little backward in their general development, and moreover, have too little muscular power to allow them any but a supine position. Thus



LECTURE VI.

The Diseases of the Mouth, and their Relation to Dentition.—Stomatitis, and its Different Forms.—Glossitis.—Parotitis.—Differential Diagnosis in relation to Etiology.—Treatment without regard to Dentition.—Muguet.—Salivation and its Causes.—Stomatopharyngitis.—Pharyngitis, Chronic and Acute.—Retro-Pharyngeal Abscess.

No part of the infantile organism is more exposed to injurious influences than the mucous membrane of the mouth, nor is there any which is more frequently observed to suffer. Traumatic injuries are not frequent, except those sometimes produced by sharp margins of teeth irregularly shaped; more frequent affections are those resulting either from chemical influences, or from an excessive degree of temperature. The mucous membrane of the mouth is very irritable, being accustomed only to amniotic liquor in foetal life, and to milk in the early stage of extra-uterine existence. Every change in the diet, therefore, the bad quality of the maternal or artificial nipples, the use of candy, sucking bags, or alcoholic beverages, coffee, or stimulants of whatever kind, will act as irritants, producing hyperæmia or inflammation in a more or less severe form. It is by no means common to observe very severe forms of stomatitis after all such preceding causes; on the contrary, the large majority of cases, including those depending on primary acute catarrh of the stomach, and the raising of a large quantity of gastric acid, so frequent in infantile age, are very mild. Nor are some of the most severe forms of stomatitis in adults often found in early age. Thus it is a peculiar fact that the influence of the external and internal use of mercury has little influence on the mucous membrane of the mouth, or the salivary glands, in infantile life. Whatever the consequences of the administration of mercurial preparations may be, salivation, or even a mild form of erythematous stomatitis, is seldom observed; in a large number of adult patients there will perhaps none be found who will not suffer from a certain amount of mercury, but of infants and children of even more advanced age, those who show mercurial symptoms are exceptions to the rule.

There are a number of indirect influences also observed to produce the common, or erythematous form of stomatitis. It will often be seen in dependence on, or in connexion with, traumatic injuries of the face, erysipelas, and hyperæmia and inflammation of the pharynx. It is further seen under the influence of many dyscrastic processes, as it is a very common symptom attending scarlatina, variola, morbilli, syphilis, and typhoid fever. It is frequently, as its causes will often continue or return, or be replaced by others, of long duration and obstinacy, like the pharyngeal hyperæmia and swelling in adults, and very generally proves a serious difficulty, although unattended by severe fever or deep-seated anatomical disorganization of any particular organ. Injection, swelling, high temperature, and slightly reddened color of the mucous membrane, copious or suppressed secretion, and pain on being touched, are the usual symptoms of the common form of erythematous stomatitis.

A more severe form is that known by the name of aphthous stomatitis. The superficial layers of the epithelium are not thrown off during the hyperæmic swelling of the mucous membrane, as in erythematous stomatitis, but a real and visible change takes place in the anatomical structure of the follicles. There is a circumscribed, punctated, vascular injection around a follicle, which is gradually infiltrated by exudation. The consecutive swelling increases in proportion, the follicles will burst and exhibit a superficial erosion, or ulceration, and the adjacent mucous membrane will be sympathetically affected. Some of these cases, which are by no means very frequent, look very much like the vesicles of labial herpes, with the only exception that they are less accumulated on a certain small locality; some may be explained by mechanical injuries, some cannot be explained at all. If it was not for those cases occurring in the first two months of life, so well described by Bednar, aphthous inflammation of the mouth would be a very rare disease; at all events the first stage will seldom come under observation, and usually the second stage, in which the vesicles are fully developed, is brought unto your notice.

That dentition, that is, the protrusion of teeth through the gums, can have nothing to do with this form of stoma-

titis, is manifest from the fact that it occurs mostly in the earliest period where teeth protrude in but very rare and exceptional cases; and that, whenever it is seen in advanced age, no connexion, either causal or as to time, can be found between the two. Much less can be said of all the forms of inflammation of the tongue known to be the consequences of caustic substances, combustion, or the poisonous stings of insects; this parenchymatous glossitis has not even been supposed by the most ardent advocates of the universal danger of dentition to be the result of its influence. Nor are the most severe forms of disease of the mouth attributed to dentition, like noma, or scurvy, or diphtheritic inflammation. They are, like the usual forms of stomacace, in which fibrinous exudations are deposited into the superficial layers of the mucous membrane, with an immediate tendency to gangrenous decomposition, well known to be not only the result of a local affection, but more so of a general decomposition of the blood. They are to be considered as the local symptoms of a general disease, the former being entirely subordinate; to say nothing of the age in which they occur by preference. Diphtheritic inflammation will occur in any age, but mostly between the first and third, at all events rarely before and during the protrusion of the first incisors; scurvy, noma, and stomacace are mostly seen in a somewhat advanced age, between the fourth and tenth years of life. In these, the local affection is something; but the larger amount of the symptoms and of danger depend on the general character of the disease.

There is another form of disease, on which nearly the same remarks may be made. Inflammation of the parotid gland, both idiopathic and symptomatic, is not a very uncommon disease, except in the age of dentition. Idiopathic parotitis will usually occur as an epidemic disease, in a similar manner as diseases of the larynx, or pneumonia, will appear as an epidemic, from some causes not perfectly understood, but depending on season and the constitution of the atmosphere; this idiopathic form is seldom seen both in the first year of life and in senile age. The symptomatic form, which will usually terminate in suppuration, and is observed in certain epidemics of typhoid fever, cholera, septicohæmia, and in some of variola, measles, dysentery, and pneu-

monia, is very rarely observed in small children; and therefore, among the causes of the above-named diseases, dentition is out of the question, with the exception, perhaps, of an occasional case of slight swelling of the parotid gland, brought on by the contiguity of the mucous membrane. I certainly do not deny the possibility of erythematous stomatitis occurring during the protrusion through abnormal gums, of perhaps an abnormal tooth, in an abnormal direction, and in an abnormally irritable child—one or more of these conditions being together, and therefore admit that a mild parotitis may sometimes occur in a causal connexion with dentition; but what I deny, and have attempted to prove by the illustration of the physiological process of dentition, is this, that diseases depending on this process are not the rules, but the exceptions. At all events, not even the slightest erythematous stomatitis must be permitted to go on the plea of dentition, unless there is at least hyperaemia of the gums, the seat of the supposed cause of disease, corresponding with the more general affection. I lay the more stress on this, as I believe I have shown by the numerous causes of stomatitis exhibited to you, that we need not be at a loss to find a cause in any given case, if we are competent to form a differential diagnosis. As long as there is certainty, we had better not resort to hypothesis or conjecture.

If a large number of cases of stomatitis was the result of dentition, why is it that a uniform mode of treatment, if any is resorted to, has not been accepted in these cases, relating to, and dependent on this cause? And why is it, that if any uniform treatment has been accepted, and is recommendable, it is just such as has no connexion whatever with dentition? And why further is it, that having no regard whatever to either teeth or gums, it is so uniformly successful? I speak of the chlorates of both potassa and soda, the effect of which in all these cases can no longer be doubted. It has long been a matter of difficulty after it had been largely introduced into practice, since the times of Hunt, West, Isambert, and others, to decide whether the effect was local or general. But the experiments of Gamberini and Semmola show, that the local effect of chlorate of potassa in mercurial stomatitis is very little, if any; but that the same remedy administered in sugar-coated pills,

had a satisfactory effect. My own experience has led me to the same conviction, although, if any focal effect is produced, it could be done by the chlorate being transmitted into and secreted by the saliva.

Another of those diseases often enumerated among the consequences of dentition is that sometimes called membranous stomatitis, now better known by the French name of "muguet."

Muguet is an affection which a few facts will prove to have not the slightest connexion with dentition. It has been generally observed in new-born infants, or in those but a few weeks old, but it is occasionally met with in more advanced life, even in adults suffering from exhausting and fatal diseases, towards the close of life. It is known by the occurrence of whitish or greyish, cream or cheeselike deposits of variable sizes, on the mucous membrane of the upper part of the digestive tract; they will be found on the lips, tongue, cheeks, pharynx, even in the larynx and oesophagus, but never in the stomach. One of its prominent symptoms, as described by adults, is a burning pain in the mouth, corresponding with the local affection; that infants suffer in a similar manner, is proved by their crying on being touched, and by their unwillingness to take the breast or swallow. Where no deposit happens to be seen, the mucous membrane appears injected, dry, and smooth, and but little mucus and saliva is secreted. In perhaps every case diarrhea has been observed; so regularly indeed, that Valleix speaks of diarrhea as one of the common and almost pathognomonic symptoms of muguet. It is, however, probable, that its cause is to be sought for in the impaired digestion, want of mastication, absence of saliva, and affection of the mucous membrane generally.

The enumeration of a number of symptoms does not explain the nature of a morbid process, or a pathological deposit; and nothing but a description of the pultaceous deposits on the mucous membrane will illustrate the morbid change taking place in the mouth. They consist of the mucus of the lining membranes, of old and new epithelial cells, of fat globules, particles of food more or less decomposed, and finally, of microscopical fungous growths of different size, with sharp outlines and indentations, from which equally composed thalli will originate, to such a

number sometimes as to form a network of dendritic parasitic tissue. The fungus was discovered by Robin, and called *oidium albicans*, and has been described by Laycock, Gubler, and a host of other medical writers. It is not known in any form differing from that found in the mouth, and it is probable that it is, as such, contained in the air, and deposited at the entrance of the digestive organs; at least no other opportunity for its occurrence on the mucous membrane of the mouth is possible. It may be transmitted by the atmosphere, or transplanted from one individual to another by direct contact, by the use of the same spoon, etc. But it will not always develop itself with the same readiness, certain conditions being required. These are an acid condition of the mucous secretion of the mouth, a certain dryness and injection of the mucous membrane, feebleness of mastication, and easy access of air. It is important to observe, that the secretion (as far as it is kept up) of the mucous membrane of the mouth is acid instead of alkaline. It is very frequently found in infants whose mouths are not kept so clean as they ought to be, who are accustomed to sleep while, or immediately after, taking the breast, and retain milk in their mouth, which soon is decomposed and acid. Muguet is therefore often found in foundling hospitals, where the inmates receive but little care, and uncleanliness is almost the general rule. Where proper cleanliness is strictly enforced, no muguet will appear, because no parasitic fungus is allowed to settle and form a crust of pultaceous matter. Thus pure water is both the best prophylactic and curative agent; the only thing worth adding is a small quantity of alkaline substance, chlorate of potassa or soda, carbonate of potassa or soda, baborate of soda or chloride of sodium. The mouth of every infant ought to be washed out after each meal, to be certain that no deposit remains on the mucous membrane. Where such has been the case, the local treatment alluded to is perfectly sufficient. The deposit is found in the superficial layers of the epithelium; it seldom reaches the deeper ones, and scarcely ever implicates the lining membrane itself. Thus cleanliness will remove the affection; the surface sometimes bleeds when the deposit is rubbed off. The addition of sugar, rose-honey, or syrup, to the water (or weak alkaline solution), must be strictly avoided; these

substances will adhere to the lining membrane and themselves undergo decomposition and prove a source of new difficulties.

The occurrence of muguet, then, is a mere accident, and has no intrinsic connexion either with a distinct morbid process, or with any certain period of early infantile development. It is no more characteristic of any constitutional disease, or general condition of the system, than *tinea favosa* on any part of the surface, which may be communicated from either man or animal, or scabies. You readily perceive that there is no shadow of a reason to search for any connecting link between the formation and protrusion of teeth and the accidental peculiar deposit on the mucous membrane of the mouth, called muguet, which years ago could be taken for a special kind of exudative stomatitis, but is now well understood.

Before leaving altogether the subject of the diseases and affections of the mouth, I desire to add a few remarks on salivation, that is, on the secretion of more saliva than is required by the ingested food or by involuntary deglutition. The secretion of the salivary glands has too long been regarded as a mere filtrating process, from the fact that in proportion to other secretions, but few solid elements are contained in it. Thus it was considered as a simple exosmotic process, in which the constitution, velocity, and pressure of the blood, nature of the walls of the blood-vessels and the glands, chemical constitution of the glandular cells, and the influence of the nerves were unknown. Ludwig has at last proven, from experiments on the submaxillary gland, that the influence of the nerves (facial and trigeminus) acts upon the secretion, without any influence of the pressure under which the blood comes into, and flows in, the gland. The same physiologist, and Czermak at the same time, have observed that the secretion is induced by irritation of the sympathetic fibres of the gland itself, and also of the trunk of the sympathetic nerve on the neck; and what is most wonderful, the latter observer has found, that under certain circumstances the irritation of the sympathetic nerves will sometimes stop the secretion brought on by the irritation of the fifth pair.

The secretion of the salivary glands appears to be under the direct influence of the brain. Bernard produced saliva-

tion by irritation of the central end of the dissected lingualis. Direct irritation of the central end of the n. glossopharyngeus has the same effect. The looking at an agreeable dish brings on salivation; so does the thinking of food while hungry, according to the experiments of Frerichs, as is also the case with the introduction into the stomach of common salt, or of food. There is superabundant secretion of saliva in ulceration of the stomach, cancer of the stomach, in the premonitory stage of vomiting, in colic from helminthiasis, in certain stages of pregnancy, in hysteria, and in cases of intermittent and typhoid fever, where we are hardly justified to attribute to salivation any importance as a "critical" symptom; in tickling the soft palate, in simple masticating movements of the jaws. Thus you see the possibility of salivation occurring on the introduction into the mouth of irritating substances, in cases of surgical diseases of the mouth, wounds and operations, and of neuralgia in the range of the ramifications of the fifth pair. Thus you perceive, also, that salivation may be produced by the irritation, though slight, of the ramifications of the maxillary nerve, around which the process of the development and protrusion of teeth is going on. At all events we are not justified in supposing that the contiguity of the mucous membrane, and the transmission of the catarrh of the mouth to the glands, are the only causes of any case of salivation. Even mercury and iodine do not appear to act first on the salivary glands. Iodine is seen in the saliva soon after it has been taken; if direct irritation of the gland was the only cause of salivation, why is it that salivation takes place so late on the administration of iodine? Mercury, too, is soon detected in the saliva, and nevertheless it takes some time before salivation appears. Moreover, the first secretion of salivation in such cases, shows that the mouth is mostly affected. For Lehmann has found, that the secretion is in the beginning thicker and less transparent, and contains more young and old epithelial cells than normal saliva; it contains much fat, little ptyaline, very rarely rhodan-potassium; and its reaction is alkaline. At a later period there are less solid elements, like the saliva secreted on artificial irritation of the nerve; it is still alkaline, contains much fat and mucous corpuscles, but no rhodan-potassium, and sometimes albumen.

Thus it is evident, that the indirect causes of increased secretion of the salivary glands may be very numerous; so numerous, indeed, that sometimes the etiology is very obscure. Thus Moore, in *Dublin Hosp. Gaz.*, Aug. 15, 1858, reports the case of spontaneous salivation in a boy of four years and a half, in whom he was unable to discover any particular cause, although the anomaly lasted for a whole month. There was no tumefaction of glands, no affection of the tongue, no medicines had been taken. The administration of chlorate of potassa and tincture of catechu proved successful.

Whenever, therefore, salivation is produced in a young child, you have to bear in mind all the possible causes of catarrh of the mouth and salivary glands, or of nervous, either peripheral or central, irritation. If you do, you will have less to say on teething and teeth, but will be more of a thinking, physiological physician.

I have noticed already that affections of the mucous membranes in general are very common in early age. One of the most easily affected is that of the pharynx. Catarrh and inflammation of the pharynx, pharyngitis, are said to occur more frequently in adults than in children; and if such was the case, this would be a fact directly in contradiction to any assumption of the prominent influence of teething in this affection. But in late years we have had more opportunity to observe pharyngitis in children than adults, this result being brought about by a number of epidemic diseases principally affecting children, and by the frequent occurrence of stomatitis. The inflammation of the mouth is undoubtedly one of the principal causes of pharyngitis, so much so that a large percentage shows both stomatitis and pharyngitis in the very same individual. Stomato-pharyngitis, therefore, is a term not unfrequently met with in literature.

I do not speak here of the chronic intumescence of the pharynx and particularly the tonsils, which is either the result of repeated acute inflammations, or is congenital. It is usually found in fair, pale, "serofulous," and weakly children, but sometimes in robust ones also, in whom the lymphatic glands generally have a tendency to become enlarged. Their deglutition is but little interfered with, but the respiratory function, formation of voice, and deve-

lopment of thorax suffer much. Such children will snore in their sleep, breathe heavily, lose their breath with every effort, show a bloated and puffed appearance of the face, slightly moving nares, a pale or sometimes bluish complexion, and, on inspection, the mucous membrane of their throat appears thickened, and the tonsils greatly enlarged. The use of styptic gargles and the application of local cauteries, is here of little or no use. In a number of cases absorbents will do better, and especially mineral waters containing iodine; but more is effected than by anything else—and surely in a large number of cases, it is the only reliable remedy—by the removal of part or the whole of the tonsils, by means of a simple bougie and Museaux's hook forceps, or by Fahnestock's pharyngotome, or, as it has been called by a barbarous mixture of Latin and Greek, tonsillotome.

Acute pharyngitis has among its prominent symptoms, redness and swelling of the mucous membrane, enlargement of the tonsils, and generally, also, the uvula, which, by being elongated, and playing about the mucous membrane of the posterior and lateral walls of the pharynx, will keep up a constant irritation and give rise to a constant, obstinate, short cough, especially immediately after the child retires. Respiration is always, even in moderate cases, interfered with, and is sometimes very troublesome indeed; deglutition is very painful, and more so with liquid than solid food; hearing is sometimes injured by the consecutive affection of the mucous membrane of the Eustachian tube. Fever is more or less severe according to the severity of the cases; sometimes the circulatory and nervous system are so much affected that severe convulsions will set in. Dyspnoea will be visible on the child's face; the cheeks will be bloated, either livid or pale, eyes injected, tonsils, and sometimes other glands enlarged, and the mucous membrane of the pharynx and tonsils highly injected, of livid velvet-like appearance, and considerably swelled. Sometimes the injection is not at all general, but will appear in spots, exhibiting, as it were, a merely local, or a number of local inflammations. The inflammatory spots will particularly appear around the mucous follicles, which then show themselves as hard, prominent, whitish accumulations. Thus, there is a great variety of cases, while those who

have a hereditary predisposition are most affected, and most exposed to relapses; and such cases as are of a phlegmonous character, being more severe, and less liable to suppuration, than those being merely superficial and erythematous. As a general rule, the prognosis is a very good one, absorption of the inflammatory swelling taking place after a number of days or weeks. Suppuration will sometimes occur, and the tonsillar abscess break after a number of serious symptoms, depending on aggravated deglutition and respiration, or chronic induration will take place, such as I have alluded to before; or the swelling of the mucous membrane, and effusion into the submucous tissue taking place to a considerable extent, oedema of the adjoining parts, thus, for instance, of the glottis, may ensue, and give rise to highly dangerous symptoms. This, however, is a very rare result of pharyngitis, scarcely any more frequent than gangrene or any of those frightful accidents, so much dreaded.

I have stated that pharyngitis is frequently complicated with, and in fact is even dependent on, the existence of stomatitis. I do not believe that after the preceding remarks you will be impressed with the influence of dentition, in producing severe affections of the mucous membrane of the mouth. Still less have we reason to attribute pharyngeal symptoms to any great extent to the protrusion of teeth. Nor is there any necessity of falling back on unknown, or hypothetical, or improbable causes, where there are many manifest ones. Acute pharyngitis is frequently noticed in the heat of the summer, complicated with troubles of the digestive organs, loss of appetite, furred tongue, headache; it is easily brought on by a sudden change of temperature, general, or local, and individual, or by the direct influence of cold temperature on the mucous membrane of the pharynx. This occurs particularly in such children as are used to breathe with their mouths open; here you have one of the reasons why it is so necessary to accustom children to have their mouth shut, and breathe through the normal passages. Other cases of pharyngitis are brought about by direct lesions, by means of hot food and beverages, stimulants, and sharp-pointed bodies coming in contact with the mucous membranes. Others are observed during the course of diseases of the tongue, bronchi, and lungs,

apparently from the mere contiguity of the mucous membrane. Another number, and not a small one, is produced by the influence of epidemic diseases. Particularly the eruptive fevers have a tendency to be localized on the mucous membrane of the pharynx, thus morbilli and variola, but more than any others, scarlatina and diphtheria. During the last few years, the influence of these two, especially of diphtheria, has been exceedingly great in this city, and a large part of the country, so much so that the greater percentage of diseases occurring in children were either directly seated in the pharynx, or complicated with a pharyngeal affection. I have been accustomed to inspect every child's pharynx when brought in for any sickness, not that every pharyngeal complication must necessarily be a very serious disturbance, but because I want to know the full range and extent of a disease, and, gentlemen, because a number of doubtful cases will be found to be nothing else but an inflammatory or exudative pharyngeal affection, in such times. The large number of pharyngeal affections occurring in this city for the last few years certainly depended on the prevalence of scarlatina and diphtheria, especially the latter; pharyngitis either following for a long time, or followed by, diphtheritic exudation. So frequent have these cases been, that it has been possible to form whole classes of cases under the heads of diphtheritic pharyngitis (without any exudation being present), and diphtheritic fever.

What I, therefore, lay particular stress on, is this—that a large number of cases of pharyngitis occur in early age, that their causes are both various and frequent, that the pharynx is particularly exposed to injuries, and that a large number are brought on by the direct influences of epidemic diseases. I may add that the protrusion of the teeth ought not to be referred to as a cause of pharyngitis, as epidemic diseases are more found after the first and second year than before. And I finally desire you to remember this caution, viz. to examine the pharynx of a child at least in every case in which the diagnosis is doubtful. By doing so you will not only reduce the number of uncertain diagnoses, but you will reduce the number of cases of "difficult dentition" considerably. You will often find pharyngitis, with or without stomatitis, to be the

simple and easily removed cause of many serious troubles attributed to dentition.

There is no more connexion between the mode of treatment of pharyngitis and dentition, than there was between the nature and etiology of both; local and intestinal derivants, diaphoretics, purgatives, and emetics have been recommended. Gargles have been resorted to in advanced children; mustard-plasters and cold water, according to hydropathic principles, have been applied. Have they anything to do with dentition, or is the protrusion of a tooth rendered easier by these, any more so than by the incision of a tonsillar abscess? I think not, nor do you; what I think is, that dentition as a means of producing pharyngitis, except in those few cases in which stomatitis and consecutive pharyngitis may be the result of an abnormal protrusion of an abnormal tooth, through an abnormal gum, in abnormally irritable children, is a very unimportant and uncommon factor. As to treatment, I should again urge the administration of chlorate of potassa, or soda, both internally and locally. I have not seen better results from any other medicine in any case which was not past the possibility of absorption.

One of the forms, or sequelæ, of common pharyngitis is retro- or latero-pharyngeal abscess. Pain is rather severe, and exudation considerable. A semi-spherical, livid, brilliant tumor is seen, or felt, on the posterior wall of the pharynx (or laterally). Respiration and deglutition are difficult; there is cough, thickness or hoarseness of the voice. Emaciation takes place from want of nutrition; fever is very high, to such a degree sometimes that convulsions ensue, brought on besides by the swelling of the tissues of the neck and compression of the veins. It generally comes on pretty slowly, and by this fact may sometimes be distinguished from acute amygdalitis or stenotic diseases of the larynx. Its termination depends on the change taking place in the abscess; if the pus is removed, respiration and deglutition are restored, and the danger of suffocation removed, and all the severe symptoms disappear. This will occur spontaneously sometimes, but in a majority of cases incision is necessary. I have observed a child of about seventeen months of age, who had to perish from suffocation, as the parents were opposed

to a simple incision into the latero-pharyngeal abscess, though easily accessible. There is, therefore, urgent danger of suffocation, from the mere size of the abscess and the swelling of the surrounding tissue, especially the velum palati and posterior nares; there are other dangers from the transmission of the process to the larynx, and thereby increasing the chances of suffocation or creating those of tedious and grave consecutive diseases; or to the Eustachian tube, thereby giving rise to either impaired hearing or perpetual deafness. The danger from deglutition is not so great, at all events food can be missed longer than air, and moreover there are other ways of introducing food into the system, besides the mouth and stomach, in cases of necessity. The chances of consecutive diseases, too, impairing the process of deglutition, are not very great, although a simple catarrhal swelling of the pharynx, or oesophagus, will fully suffice to give rise to a constant dysphagia.

Retro-pharyngeal abscesses are seated in the cellular tissue connecting the pharynx and vertebral column. They may well be classified under three heads. Some are developed idiopathically, from an inflammation of the mouth and pharynx, and the surrounding tissues, the inflammation originating from either a simple catarrhal affection or a metastatic process, influenced by an acute exanthem, typhoid fever, or pyæmia. The majority of the cases of this form occur before, or at the time of the first dentition; this period of life showing generally the greatest tendency to catarrhal affections. This simple physiological fact has evidently been the reason why retro-pharyngeal abscess has been thought to depend on, and to be caused by, the protrusion of teeth. The prognosis in cases of this class is generally favorable, unless the incision of the abscess is neglected; with the only exception of metastatic abscesses, which are but symptoms of a more or less grave affection of the whole system. Therefore, in these latter cases, every hope of a lasting cure depends on the possibility or probability of a cure of the original morbid process. Idiopathic abscesses generally, when in their first stage, require a rational antiphlogistic local treatment; application of cold, both externally or internally, the latter by slowly swallowing ice, or gargling with ice-water, with or without alum; local application of nitrate of silver, or alum; scari-

fications of the pharynx; leeches. When the other stages of the inflammatory process cannot be repelled, warm poultices appear to be preferable, except in instances of imminent danger from symptoms of cerebral congestion; in these cases warm emollient gargles do better. Internal treatment is unavailing, except for the purpose of diminishing the fever, or other dangerous symptoms; tartar emetic has been frequently recommended, but also rejected. Where the symptoms are very grave, and suffocation imminent, the safest and quickest remedy is incision of the abscess, and the washing out afterwards of the abscess, by gargling or syringing. Metastatic abscesses require incision, only to remove the utmost danger from suffocation, as the principal attention has to be paid to the general process. After the incision has been made, water is not sufficient for the wound to heal, but stimulants and astringents, chloreum calcarie, alum, nitrax argenti, acidum tannicum, are required, and an internal treatment has to be resorted to, according to the general affection; bark and mineral acids will often prove necessary.

The second class of retro-pharyngeal abscesses are secondary, being produced by the suppuration of inflamed lymphatic glands, and the surrounding tissues. They are rarely found in early infancy, viz. at or before the time of the first dentition, but at a later period, which is more favorable to scrofulous and inflammatory swellings of the lymphatic glands. It is not our fault that the second dentition may fall within the range of this period. The prognosis in these cases is not very unfavorable, although it depends on the gravity of the original suppuration, and the amount of general morbid affection. The local treatment is much like that recommended in idiopathic cases, with this exception, that the original glandular abscess requires particular attention. Incisions from outside will frequently suffice to remove all the pus formed, and to relieve the consecutive pharyngeal and laryngeal injection. The gravity of the general dyscrastic affection, which gave rise to the primary suppuration, requires great care; iodide of potassium, iodide of iron, cod liver oil, air, exercise, attention to the skin, and generous diet, being strongly indicated.

A third class of retro-pharyngeal abscesses owe their

origin to the suppuration of cervical vertebræ, or their ligaments. They are seldom found before the age in which secondary abscesses have been observed, caries of the cervical vertebrae and well-developed tubercular disease generally being more common in later life. Their prognosis is very unfavorable. Incisions, which ought to be made as late as possible, are only of momentary use, they being unavailing in relation to the primary affection. As in all such diseases as resist treatment (all being nearly hopeless), a large amount of remedial agents, dietetic and pharmaceutical, have been recommended; you may consider it to be a general rule that the number of remedies (infallible remedies) recommended, increases in proportion to the hopelessness of a disease or a given case. Quiet, posture, cold, leeches, mercury, and wine, both externally and internally; calomel, nitrate of potassa, tartar emetic, iodide of potassium, and iron, have been recommended, according to indications. They have been used and abused in many cases. These will generally terminate fatally; either slowly, by hectic fever and exhaustion, or very suddenly indeed. I have seen a young man die suddenly while turning his head on the pillow. Making the post-mortem examination I found the ligaments of the vertebral column, in its upper part, mostly destroyed; a few remnants had been torn by the last move of the patient, and the process of the axis entered the foramen magnum, destroying the tissue of the medulla oblongata.

LECTURE VII.

Gastro-Intestinal Canal.—**Vomiting.**—**Its Physiological and Pathological Causes.**—**Catarrh of the Stomach.**—**Diarrhoea and its Relation to Dentition.**—**Its Nature and Different Forms, and their Common Symptoms.**—**Variety of its Causes.**—**Local Irritation by Ingesta.**—**Season and Atmosphere.**—**Age.**—**Ulcerous Processes and Constitutional Diseases.** **Nervous Influences.**—**Obstruction to Circulation, in the Portal Vein, Inferior Cava, and in the Skin.**

THE gastro-intestinal canal of infants and children is very liable to diseases; among the causes of which irritants, helminthes, hot weather, sudden changes of temperature, nervous disorders, and rachitic, scrofulous, and tubercular dispositions take a prominent place. Dentition, too, is considered to be a principal cause of anomalies in both functions and structure of the stomach and intestines. Of these two the former suffers decidedly less than the latter; for the development of many diseases of the stomach, which prove very troublesome in advanced age, require time, while deep-seated disorganizations and thoroughly disordered functions of the intestinal canal are by no means rare. It is worthy of notice, however, that almost all the affections met with in the gastro-intestinal canal, are found on or in the mucous membrane, the muscular and peritoneal layers showing less tendency to derangements. Now, the affections of the mucous membranes are of a more or less similar description, catarrh and inflammation, with their consequences, being the prominent pathological processes really observed. The series of phenomena visible to superficial inspection are equally simple and uniform; vomiting and diarrhoea, with occasional pain, and several other less prominent symptoms, have alone attracted constant and undivided attention. They have been brought in connexion, more than any other, with the process of dentition, and it is certain that there are no symptoms appearing more frequently during its course. It is therefore of particular importance to consider these two symptoms at some length, in order to learn their importance either as symptoms or dangers of dentition.

I have applied to both vomiting and diarrhoea the term of symptoms, wishing to impress upon you this fact, that they are no more real diseases than pain, or cough, or convulsions, or any other affection that may be produced by a number of different causes, although showing a similar character in different cases. Let us consider first, therefore, how vomiting may originate in infantile age, and of how many conditions of the body it may be a consequence and symptom; we shall then be better able to trace its connexion with dentition to its proper source.

Vomiting is a very common occurrence in infantile age, and in a large number of cases is anything but a disease, or symptom of a disease. The stomach of the newly born is small, holding but a few spoonfuls of liquid when undilated; it remains for some time in its foetal state, in which the two curvatures exhibit but a slight difference in length; its position in the abdominal cavity is vertical instead of horizontal, and its appearance more like that of a dilated part of the intestinal tract than the stomach in the adult. It is entirely covered by the liver, which, from being the centre of circulation in foetal life, is exceedingly large in early age, so much so that its left lobe nearly equals the size and weight of the right, and extends as far as to cover the upper portion of the spleen. Therefore the stomach will throw off its contents in early infantile age without any affection of the organ itself. A simple pressure over the stomach, shaking or tossing, tight bandages, and a superabundance of breast milk swallowed, are amongst the most frequent causes of vomiting in early age. It can scarcely be called vomiting, it is more like an overflowing after overfilling; the usual symptoms of genuine vomiting, exhaustion, small pulse, paleness, and faint feeling, are not observed. So easily, indeed, will the stomach eject its contents that emetics, whenever given, will also act without the protracted disagreeable symptoms always observed in adults, and that the mother is accustomed to consider the throwing up of milk, in the nursing, as a very favorable symptom. It has become proverbial almost all over the world, that infants throwing up most will thrive best. Although this opinion can easily be reduced to its proper value, viz. that it is due to the abundance of proper food such infants have, etc., still it shows that no immediate serious injuries result there-

from. It follows, moreover, from what I have said of the causes of this throwing up, that nothing is more easy than to avoid it as far as it can be influenced by external means. If you avoid pressure on the epigastric region by both hand and dress, and allow the nursling to enjoy undisturbed quiet after taking his meal, disturbing him no longer than is necessary to cleanse his mouth, forbid tossing and shaking, and carrying in prone position, and take care not to overfeed him, you will not witness this symptom frequently.

Thus far vomiting has appeared to be almost a normal function, or rather the result of a mild external influence and not at all a disease or disorder. Of a similar character is the occurrence of vomiting in a child a little advanced, as when, for instance, severe attacks of coughing have the same effect. The vomiturations and vomiting in hooping-cough are mostly of a mechanical character, being caused by the spasmodic pressure of the diaphragm and abdominal muscles, and thus far show no connexion with either a local disease or a general affection. They are, therefore, not attended with danger, except that resulting from the diminished introduction into the system of well digested food.

In cases where the foetal position of the stomach remains unchanged in later life, habitual vomiting is a common symptom. It is, therefore, not of much consequence, and proves more troublesome than dangerous. Other mechanical causes are not so harmless; as obstinate constipation, which will sometimes produce antiperistaltic action of the intestinal canal, and obstructions impeding its permeability, as incarcerated hernia, umbilical, inguinal, or femoral, and invaginations of the intestines.

Too large an amount of food irritating the stomach, has been pointed out as a cause of vomiting. But the quality of food acts in a similar manner. Inappropriate food will certainly not be borne by the stomach for any length of time, nor will irregularity in the time of feeding small children agree with the normal functions of the infantile digestive organs. We hear, occasionally, of cases in which mental emotions in the nurse, with their influence on the constitution of the milk, proved the source of serious disease, or even of death, to the child; and those cases in which a direct and palpable change in the elements of food has taken place, are unfortunately too numerous not to be

known to any young practitioner. The nature of the undigested contents of the stomach brought up, will frequently explain the cause of vomiting. When milk is vomited, coagulated, immediately after being taken, it shows that either the milk or the stomach contained free acid. It is of some practical importance to know that this occurrence may be usually avoided by adding a small quantity of bicarbonate of soda, besides a little chloride of sodium, to each meal. When the milk is vomited some time after it is taken, in a state of loose coagulation, it proves that the condition and function of the gastric juice are normal; when, on the contrary, it comes up again after some time has elapsed, uncoagulated, there is either a want of gastric juice that requires the administration of pepsine; or, if the caseous matter looks like tough mucus, there is evidence that chronic catarrh is present, in which case pepsine is of no use.

Vomiting due to the condition of the stomach and the ingested food, is most frequent, and it may be safely stated that such cases depend upon organic disorders of the stomach, when the vomiting occurs while the stomach is filled. Cases in which vomiting occurs with an empty stomach will prove obstinate, as they depend on some anomaly of the nervous centres; thus, for instance, in cerebral tumors, exudative processes, or in vomiting occurring in the first stage of many diseases attended with fever. It is almost always observed among the premonitory symptoms in scarlatina, and frequently in other eruptive fevers; and is so often met with in the commencement of pleurisy and pneumonia, that these diseases, before exudation took place, have sometimes been mistaken for an affection of either the digestive organs or the nervous system. I have known vomiting to usher in attacks of intermittent fever. Is it to be explained by the fact that the functions of the stomach are always interfered with in diseases attended with fever, both in infantile and adult ages? I believe not, for we certainly could not with such an assumption explain the other fact that no vomiting will occur in the second or third stages of pneumonia, or pleurisy, and in the prolonged course of normally developed eruptive fevers, although the appetite is no better, nor the faculties of the digestive organs in any respect improved. We must assume that the fever has the influence of producing the

anti-peristaltic motion by its action on the nervous system, for we sometimes observe that vomiting will, *ceteris paribus*, occur more frequently in one epidemic than in another. That the nervous system, or rather the brain and the vagus nerve, have the influence of forcing the stomach into anti-peristaltic motions, is well known. Mental emotions in the child even, will give rise to vomiting. In cases of either uremia or embolia in the course of eruptive fevers, especially scarlatina, one of the first symptoms will again be vomiting. Vomiting is further well known as a symptom of cerebral disease, where the stage of irritation has not passed into that of too copious exudation and entire depression. Its occurrence, therefore, as a common cerebral symptom, is of great importance, not only the presence but the stage of cerebral disease being thereby announced. There is one disease, particularly, in the premonitory stage of which the occurrence of vomiting has acquired the reputation of being a pathognomonic symptom. I mean acute meningeal tuberculosis, or, as it was formerly called, acute hydrocephalus. While acknowledging the importance of vomiting as a diagnostic symptom in this fearful disease, I have, I think, found from a certain number of cases, that it cannot be regarded as absolutely pathognomonic. A limited number of cases have, on post-mortem examinations, revealed to me tubercular deposits on the arachnoid membrane, where the absence of vomiting would have excluded the diagnosis of tubercular meningitis. The difference found by me hitherto, and which I hope to verify by further experience, is this—that vomiting is a regular symptom in tubercular meningitis of the base of the brain, while it is the rarer the less the basis is affected. The immense majority of cases are those in which the fossa Sylvii and the base generally suffer most. But I remember two cases, in which there were tubercular deposits over the surface of the large hemispheres alone, with but moderate liquid exudation; in these no vomiting was observed. I further remember two cases in which the mass of tubercular deposits was on the same place, a few being found at the base. In these cases vomiting would occasionally take place. I hope, therefore, we shall be able yet to detect a diagnostic difference between the symptoms of tubercular deposits on distinct regions of the brain.

The majority of cases of vomiting, however, depend on some affection of the stomach; and yet severe affections of this organ are very rare in children. Usually the mucous membrane is in a hyperæmic condition, and the secretion altered in its character. Alimentary injuries, entozoa, refrigeration, and nervous disorders, have been alluded to as causes of, and some general morbid dispositions, like scrofula or rachitis, are known to be in intimate connexion with, gastric catarrh. The warm season is generally so productive of diseases of the gastric and intestinal mucous membrane, that the number of cases will generally be found to increase or decrease, according to the variations of temperature. Vomiting is a constant symptom in nurslings affected with catarrh of the stomach. But as I have stated above, it is characterized by the milk being brought up in an uncoagulated condition; coagulation will take place either on the influence of the normal gastric juice, or of free acid contained in superabundance in the secretion. Coagulation not taking place, and the usual admixture of mucous masses, show that the secretion is abnormal, and has no effect on the ingesta, and that much mucus is contained in the stomach. Soon after, or from the beginning of the first symptoms of gastric catarrh, the evacuations of the bowels commence to change. They consist of a greenish, or yellow-greenish, or yellowish liquid of acid reaction, and of white or yellow small lumps. The general appearance of the patients is not at first much altered; the countenance, however, is pale, the cheeks a little bloated, the eyes sunk. The expression of the face is quiet until colics make their appearance; the large fontanel is not sunk; temperature of the skin, number and mode of respiratory movements, and sounds and impulse of the heart are quite normal, voice loud and clear, and the voluntary movements of the little one not interfered with. The mucous membrane of the mouth, and especially the tongue, look abnormal. The tongue of older children is generally furred and whitish, being covered with thick layers of mucus and epithelial scales. The condition of the tongue, however, is far from being a pathognomonic symptom. Catarrh of the mouth and tongue, and of the stomach, are usually found combined, but frequently without any connexion. Many mistakes, therefore, will be

made, by drawing conclusions, from looking at the tongue alone, on the condition of the mucous membrane of the stomach; and nevertheless, you will often see the entire diagnostic skill of both professional and unprofessional doctors to consist in the scrupulous and religious regularity with which they act as official tongue-inspectors.

Very young infants show more regularly some affection of the mouth and tongue. It is injected, swelled, the epithelial layers partially thrown off, and the papillæ often elevated. In them there is always a direct connexion between the catarrhal affection of the mouth and stomach, but not in the manner supposed by the partisans of difficult dentition. In their opinion, the catarrh of the stomach is the consequence of the catarrh of the mouth induced by "dental irritation;" the truth is, that the catarrh of the mouth is brought on by the raising of the acid secretion of the catarrhal mucous membrane of the stomach. Nor is anything in the medicinal treatment which can be taken to announce any direct connexion between gastric catarrh and difficult dentition. Neither calomel, nor rhubarb, nor bismuth, nor alkaline carbonates, nor nitrate of silver, nor muriatic acid, all of them much used in the acute gastric catarrh of infantile age, is known to ease the protrusion of teeth; they are administered for their direct effect on the mucous membrane of the stomach. And the diet, finally, advisable for infants not fed on breast-milk, as both curative and prophylactic, does certainly not show a dependency of gastric catarrh on anything but a direct and local injury. Some hints on the use of milk, on which infants ought to be fed almost exclusively, in regard to the affection alluded to, may be of some practical importance, and deemed worthy of your notice. I shall be brief in adding them. Always use cow's milk as fresh as you can. You cannot always expect milk, even in the ice-box, to keep from one morning to the next. Boil the milk, to postpone the transformation of the sugar into acid. Diminish the amount of sugar to be added to cow's-milk in acid secretion of the stomach. Where there is the least suspicion of acidity add a small quantity of bicarbonate of soda. Where there is the least suspicion of acid secretion in the stomach, add some vegetable slime (barley, oatmeal, arrow-root, according to circumstances), to prevent rapid and hard

coagulation. The regular addition of chloride of sodium to every meal will also add to the digestibility of the food. Never use swill milk; never give milk undiluted; never consider milk as a beverage, but always as food; give water when infants are thirsty, and never give food while they are still well oftener than once in two hours, in the first month of life; never oftener than once in three hours, after the first or second month. Make the intervals longer in case of catarrh of the stomach, which diminishes the digestive power. Never regard the violent screaming of an infant affected with gastric catarrh as indicating hunger; they will sometimes appear to be voracious, mistaking the disagreeable feeling of the peripheric ends of their vagus nerve for the sensation of hunger. Keep the affected organs of digestion from over exertion, as you would a sore limb.

Amongst all the morbid symptoms of early infantile age there is none more frequently attributed to dentition than diarrhoea. I say, amongst all the morbid symptoms. For we must remember that the term "diarrhoea" means nothing but the frequent evacuation of faeces and intestinal secretion from the anus. A number of causes may contribute to the same result. Many cases of diarrhoea depend on mere disorders of the intestinal mucous membranes, some result from an exalted muscular mobility of the intestinal tract, and some from direct anatomical lesions. The latter, although they have been present during life, are not always found in post-mortem examinations; injection of the capillary, and larger vessels also, will, after death, from mere change of position or other influences, change its character. It is well known, that cerebral hyperæmia which has caused death, will not always be found, the blood finding its way into other parts of the body; and injection of the vagina, the fauces, and conjunctiva, is frequently looked for in vain after death. Thus we need not be astonished at not finding the post-mortem signs of hyperæmia in all the cases of intestinal catarrh, especially those of acute character. Those cases, however, which have taken a chronic course will be sure to exhibit anatomical changes, the nature and pathological bearing of which cannot be mistaken; in them the melanotic margins of the glandular follicles, the dilatation of blood-vessels, and intumescence of the mucous membrane, is found to correspond with the various excretions during life.

These excretions, either evacuated during life, or found post-mortem in the intestinal tract, are most characteristic and the most constant symptoms, so much so that some authors have thought best, from misconceived notions upon the subject, to classify diarrhoea according to the character and abundance of the evacuations. However, there are some elements common to all and any kinds of diarrhoea, whether acute, chronic, primary, secondary, or metastatic, viz. the epithelial scales of the intestinal mucous membrane. Their rapid ejection and transformation form the essential part and nature of the catarrhal process, whether the case is one of those thousands terminating favorably, or of those rapidly exhausting and frequently fatal ones of infantile cholera, or those lingering and slowly destroying cases of tabes infantum.

Diarrhoea is excessively frequent in children during the earlier years of their lives. Many cases, brought on by mechanical irritation, appear to have a wholesome character, in removing the injurious substances from the lumen of the intestinal tract. Many other cases of common acute catarrh of the intestinal mucous membrane are no more dangerous than these, a moderate transudation and somewhat accelerated peristaltic action being the only symptoms, which often disappear in a few days. Even at the time of dentition, that is, at that period of infantile development, in which all the elements of the body, particularly the head and the glandular system, are undergoing rapid changes, diarrhoea will not often be attended with serious difficulties, especially in such children as show some tendency to hyperæmia of the cranium and its contents. But we have no right to assume that, because such a diarrhoea during dentition, that is during the first thirty months of infantile life, may not be attended with serious consequences, this very diarrhoea forms a necessary part of dentition. If any superstition has proved dangerous, it is the belief that diarrhoea during dentition must not be stopped; it has been the fruitful cause of mischief in hundreds of children. We may safely say this, as even chronic cases of diarrhoea permit of a favorable prognosis, and not even the follicular ulcerations of the colon give an absolutely fatal prognosis, except in cachectic patients.

In order to prove that there is no necessity whatever in

resorting to dentition as a kind of scapegoat to explain the diarrhoea of infantile age, we need but enumerate a number of such causes on which diarrhoea is universally acknowledged to depend. The more numerous these causes are, the less necessity there is for dentition to shoulder the blame in every case; the less so, as there are but two principal connecting links between the protrusion of a tooth and the intestinal catarrh; not to speak of those numerous would-be causes dwelt upon at some length in a previous lecture. These principal links are, either nervous irritation, or the undeniable sympathy between distant parts of the same tissue. But we have seen the scarcity of cases of local stomatitis, or rather gingivitis, during the protrusion of a tooth, and certainly we cannot expect an inflammation which is not, to give rise to a catarrhal process that is.

Injurious ingesta are the prominent causes of diarrhoea in children. Purgative medicines; maternal milk over-loaded with, or deficient in fat, salts, or caseine, or affected by mental emotions, or by the action of purgative medicines, rhubarb, senna, salts, calomel, etc., all of which have been found in the milk, and are known to act on the nursing; artificial feeding with amylacea, either too soon, or too copious, or decomposed; super-abundance of sugar in the food; retention and putrefaction of particles of food in the mouth; retention of sugar solution from a sucking bag; the mere change of nurses, or weaning; these and other causes, will suffice to give rise to very obstinate diarrhoea indeed. Especially, the time of weaning is a dangerous one, in this respect.

Another very frequent cause of diarrhoea, is high temperature. You know that dentition will take place any year, or month, or season, but you are also aware of the fact, that the occurrence of diarrhoea is very much influenced by season and temperature. We know, for instance, that the cases of intestinal catarrh, with or without catarrh of the stomach, especially the severe ones known by the name of cholera infantum, will frequently appear in New York about the middle or end of June, will reach their highest number in July and August, will diminish in September, and disappear in October. A few only, protracted and tedious cases of follicular ulcerations

of the colon, will remain until November or December. In southern climates, infantile cholera will appear sooner; it will be observed in the beginning of June, and last to October, in Pennsylvania, Ohio, Maryland, Kentucky, and Virginia; and is observed, from April to November, in South Carolina, Florida, Alabama, Louisiana, and Mississippi. It is also well known to every practitioner, and to every careful observer, that every cool day interrupting a series of warm days, will diminish the number of cases, as every increase in temperature, combined moreover with moisture in the atmosphere, will rapidly increase it. Epidemics of infantile cholera are observed, according to Hexamer, as soon as the average temperature of the month has reached sixty-nine degrees; it is on its height at from seventy-one to seventy-eight, and disappears when the temperature falls below sixty-five. In 1816, when July averaged sixty-one, and the three summer months but sixty-eight degrees, there was but one fatal case of infantile cholera in the city of New York.

The very age of children appears to predispose them to diarrhoea. Prematurely born children are known to suffer much from it, but they are generally liable to a great many disorders. Mature children will suffer the more the younger they are, the first week of their life not excepted. The frightful cases described by Ricordeau, by the name of *enteritis choleriformis*, with their vomiting, greenish serous diarrhoea, high fever, cool skin, senile expression, retention of urine, and partial cyanosis, and known to us as bad forms of common infantile cholera, have been proved to be particularly fatal in this early age. The first month of life is, according to all the statistics, that in which diarrhoea occurs most frequently, and proves most fatal, both the frequency and fatality decreasing from month to month. Nevertheless, these are the months in which, what is generally called dentition, does not take place. The well-developed cases of severe gastro-intestinal catarrh (infantile cholera) are more frequent in the second and third half year, but according to my observation, just as many occur before the first year as after. Thus, neither the "eye-teeth" nor the "second summer" are to be blamed so much, after all. But there is some truth in the blame thrown on the second summer. A child born in the course of winter

or spring, is from fourteen to twenty months old in his second summer; he is probably weaned, and then liable to gastric and intestinal disorders depending on being fed, over fed, and badly fed; or he is kept at the breast by the too careful mother, who is fearful of some imaginary constitutional disturbance. The infant, consequently, is forced all summer, to take improper food, the nutriment of a nursing inappropriate for the digestive organs of a boy with from twelve to sixteen teeth in his mouth. After two years, the tendency to diarrhoea is decreasing, particularly the number of fatal cases of cholera infantum. Of 1525 cases of cholera infantum proving fatal in New York, in the year 1854, but 154 were over two years of age.

Many severe diseases of a more general character are liable to become complicated with diarrhoea. Typhoid fever and tuberculosis belong to this class; the increased secretion of the intestines and the enlarged number of evacuations depend on the number and size of the local ulcerations of the peculiar well known character. Umbilical phlebitis, and peritonitis, have sometimes diarrhoea as an accompanying symptom, from obstructions taking place in the circulation of the adjacent organs; for œdematosus swelling and transudation is a very common symptom of adjoining inflammation, a process the illustration of which is also well given by puerperal peritonitis. In acute exanthems diarrhoea is not a very rare occurrence. Thus it is one of the most severe complications occurring in the course of scarlatina. In infantile syphilis it is also a severe symptom, showing that the local ulcerations of the mouth or anus have influenced the mucous membrane of the intestinal tract by either sympathy or contiguity. And in rhachitis, diarrhoea is not only frequent, but sometimes very obstinate. Rhachitis is not so much an original blood disease, but more probably it owes its general character to the influence exercised by the allotted functions of the digestive organs. Although the well known affections of the osseous system are its prominent symptoms, in its fully developed course, one of its usual and early characteristics is, for instance, enlargement of the liver. Every cause of obstruction in the course of circulation of the portal vein, thereby accumulating a superabundance of blood in the small venous vessels of the intestinal canal, has the effect of

producing transudation in the canal—diarrhoea. We thus approach at once another class of the general causes of diarrhoea, that of obstructions in the circulation of the portal vein, which, although more frequent in adults, is not unfrequently met with in infantile age. Interstitial inflammation, or cirrhosis of the liver, is mostly seen in adults, with its sequelæ of transudation from the ramifications of the portal vein; but it is an occasional occurrence in children also. And enlargement of the liver, with its consequences bearing upon circulation and digestion, is not so uncommon in early life that we ought to overlook it as one at least of the possible causes of diarrhoea. At all events, in no other manner can the diarrhoea of rhachitical children find a more ready explanation.

From your general knowledge of physiology and pathology you know that every repulsion of blood into or retention in the system of the vena cava inferior increases the size of the liver, and produces all the symptoms thereof. You know that a number of diseases of the heart and lungs, or the large arteries, have among their prominent symptoms enlargement of that organ. The liver is moreover, being of a glandular structure, and provided with immense nets of capillary vessels, so capable of instantaneous swelling, that like a sponge it keeps in its cavities any amount of blood not needed or not allowed in other organs. That chronic, and even acute diseases of the heart or lungs will instantaneously produce hyperæmia and swelling of the liver, is well known. Thus I have seen in endocarditis with incompetency of the mitral valve, not only catarrh of the lungs, but hyperæmic enlargement of the liver, icterus from the swelling of the mucous membrane of the biliary ducts, and severe diarrhoea from the hyperæmic state of the intestinal ramifications of the portal vein not allowed to freely circulate its contents in the engorged condition of the organ. And thus we learn at once the important nature of a symptom which has often set at naught all the skill and knowledge of physicians. I speak of the diarrhoea not unfrequently attending the course of a severe pneumonia in the infantile lung.

From the general nature of mucous membranes which we shall yet have to examine a little more thoroughly, you know that they are liable to be affected contempor-

neously in distant parts or organs. The cause of this fact I shall here seek in the sympathetic connexion between distant parts of the same tissue, and in the equality of the cause producing such an affection. Thus it is a very common occurrence to find in the same individual, from the influence of a sudden change of temperature, both a bronchial and intestinal catarrh, or broncho-pneumonia, as generally observed in infantile age, and the same catarrhal process in the intestines. In such a case these two affections are but the co-ordinate symptoms of the same cause, and certainly the prognosis of the one is impaired by the very presence of the other. But this is not the worst case. Sometimes in the course of a severe broncho-pneumonia, and usually in its second stage, intense diarrhea will set in. This is to be explained in this manner. The previous bronchitis has been very general, and at the very same time a large number of lobuli have been affected, perhaps even bilaterally. Hepatization takes place, not of the same character as in the inflamed lungs of adults, it is true, but to the same extent; the nature of the affection being satisfactorily proven by the large circumference of the dull percussion sound and the extent of bronchial respiration. There is no more free circulation of the blood in the lungs, it is accumulated in the system of the inferior cava, and produces enlargement of the liver; it is retained in the portal vein and its territory, producing intumescence of the intestinal mucous membrane, and transudation—diarrhoea. The relation, therefore, of this secondary diarrhoea to pneumonia is this: firstly, that it shows the affection to be very severe and widely-spread, and secondly, that it impairs the prognosis by abstracting from the body a large amount of albuminous and other necessary elements. This complication of diarrhoea with pneumonia has always been known as an unfavorable symptom; there being no means of removing the secondary symptom with the danger attending it before relieving the liver from the large amount of blood forced upon it, that is, before removing the infiltration into the pulmonary tissue. After all, the hyperemia of the intestinal mucous membrane following the obstruction in the lungs, according to the ingenious remark of a modern writer, takes the place of cyanosis on the external skin.

Peripheric obstruction to circulation is of a similar influence on the secretion of the mucous membrane of the intestinal canal. Combustion of a large proportion of the surface of the body is always followed by diarrhoea; and the sudden contraction of the blood-vessels by the influence of a sudden change of temperature, is too well known to need any further comment. If I, nevertheless, allude to these causes of diarrhoea (as above I ought to have pointed to the internal and local irritation produced by helminthes and muguet, to the crowded population and unclean condition of foundling hospitals and poor quarters, etc.), it is for this reason that I wanted to present to your mind in as narrow a frame as possible, all, or nearly all, the causes of diarrhoea. I did not care for illustrating the symptoms of its several forms, as they will form part of another course of instruction; and as there is no form, neither mild nor severe, that you will not hear attributed to dentition; nor did I speak of treatment, as there is no treatment of diarrhoea that is anywhere or anyhow connected with dentition.

That mental excitement, fright, and anxiety, are in many instances the direct cause of diarrhoea in children and infants, showing their effect not only in increased secretion, but also in paralysis of the sphincter, cannot be denied, except by those who think too little of the development of the mental faculties in early age. That they have the same effect in adults is well known; and by direct physiological experiments, the connexion between the action of nerves, and diarrhoea has been placed beyond any doubt, since Budge gave rise to incessant diarrhoea by extirpating the ganglion cœliacum.

LECTURE VIII.

Anatomy and Physiology of Mucous Membrane in general.—Nature of its Secretion.—General Pathology of Mucous Membrane.—General Etiology.—Primary and Secondary Nature of Diseases.—External Injuries.—Cold.—Atmospheric and Epidemic Influences.—Constitutional Poisons.—Contiguity and Sympathy.—Different Forms and Symptoms.—Dentition, and the Etiology of the Affections of the Respiratory Organs, Ear, and Eye.—Urinary and Sexual Organs.—Catarrh of Bladder.—Incontinence of Urine.—Ischuria.—Balano-posthitis.—Catarrh of the Vagina.

I HAVE several times alluded to certain qualities and actions of the mucous membranes in general. But you will better understand many of the foregoing remarks, after following me in the investigation of several anatomical and physiological facts, concerning both the structure and function of the mucous membranes. And certainly, they are deserving of every attention that can be bestowed upon them, not only on account of the large surface they cover, but also in consequence of their physiological and pathological importance. As the cutis forms the external integument of the body, so does the mucous membrane form the internal covering of any and all the organs. Thus, we find them all over the respiratory, digestive, uropoietic, and sexual organs, and in all those isolated cavities, like the maxillary and frontal ones, which are connected with the larger ones by narrow ducts; further in the glands, the affections of which are either genuine and primary, or continuations only of a morbid process on a mucous membrane, and their ducts; the conjunctivæ, the external ear, and the galactiferous ducts of the female breast.

The mucous membrane of an organ or a system is not confined to certain limits. Except on the lips, on the external ear, and other localities where we distinctly perceive the gradual replacement of epidermis and cutis by mucous membrane, we are nowhere enabled to determine where the mucous membrane of this organ or system finds its end, and that of the other commences. Thus, there is no boundary between the mucous membranes of the digestive and the respiratory organs, nor any between that of the stomach and the duodenum. Their internal structure is

alike, and therefore I deem it more proper henceforth to speak rather of mucous membrane, than of mucous membranes. Its uniform layer consists of dense connective tissue, intermixed with bloodvessels and elastic fibres, in its deeper laminæ with muscular fibres also, and is covered with several layers of epithelial scales, which are readily thrown off and renewed; they may, however, be accumulated in yellowish, brownish, or black masses. Beside the bloodvessels there are lymphatic vessels, and the smallest ramifications of nerves, which are particularly found in the papillary prominences. They are either the last ends of a cerebral or spinal, or of the sympathetic nerve; the peculiar actions of these several nerves determining the functions of the locality in which they spread. The mucous membrane, influenced by the cerebro-spinal system, is more sensitive, as a general rule, than such localities in which the power of the sympathetic prevails. Thus pain depends on the seat of the affection just as well as on its acuteness; the degrees of temperature are discerned by the pharynx, but not by the stomach or intestine; urine produces no pain whatever on the mucous membrane of the urinary bladder and urethra, but very much so on that of the conjunctivæ; and often irritations meeting a mucous membrane effect no pain nor other local disturbances, but sympathetic sensations, like coughing or sneezing.

The functions of the mucous membrane are both various and important. It takes a prominent part in assimilation and sanguification, and therefore suffers in all general, and all those local diseases that in any way influence the general condition of the organism. They are frequently first affected in a large number of diseases, many of which are primary; for the immense extension of mucous membrane, increased by indentations, villi, glands and glandular ducts, and papillæ, is such that morbid processes may easily take place in one part or another. The influence of the diseased mucous membrane is, moreover, as great as its affections are frequent; the vital importance of the membrane itself, the legions of nerve ramifications in its tissue, and the contiguity and rapidly developed consecutive affections of the mucous membrane contributing to the same result. The occurrence of œdema of the glottis in catarrh of the pharynx or larynx, or of collateral œdema of the

vocal cords in diphtheritic inflammation of the larynx, are distinct and much dreaded proofs of this fact.

In its normal condition the mucous membrane exhibits a peculiar tough, whitish or clear, more or less transparent, alkaline secretion, called mucus. It contains mostly epithelial scales, more or less transformed, of every variety; pavement, cylindrical, and vibrating, the latter without cilia; further, round granulated cells with one or more nuclei, and a clear transparent liquid. Epithelium, mucus, and pus, are found combined in many instances of secretion on the mucous membrane, the three various forms being, in this locality, but three different stages of the transforming epithelium. Under favorable circumstances, the mucous membrane forms puriform elements anywhere, but there is some difference in the process. The purulent mucus of the intestine contains very seldom puriform elements, that is, pus cells, except in cases of genuine ulceration; the same result is found on examinations of the purulent mucus of the uterus and tubes. But no ulceration is required in the mucous membrane of the bladder or urethra to count immense numbers of pus cells in the puriform secretion of chronic vesicular catarrh and gonorrhœa. This difference depends on anatomical reasons. The intestine, uterus, and fallopian tubes, have cylindrical epithelium only, bladder and urethra, however, pavement epithelium. The mucous membrane will develop the more pus cells without the presence of real ulceration in proportion to the amount of pavement epithelium by which it is covered. Purulent though the secretion of other parts of the mucous membrane will look, it contains frequently nothing but cylindrical epithelium. The angular shape of the pavement epithelium enables it to form a cohering covering, which is not thrown off so easily as the round pus or mucus cells. Thus the lower layers have full time to develop into mucus cells; which result being obtained, the whole mass is thrown off by either the pressure of the subjacent new layers, or the influence of a thin and less cohesive transudation from the blood-vessels, which, in its turn, forms another important element of the secretion. Whether it has a more important part than to be one of its elements, whether, for instance, from its substance cells may be developed, or whether the cells are under all circum-

stances but the later stages in the development of epithelial scales, is still an open question. This is certain, that what is called mucus is by no means always the same liquid, no more so than that the secretion of the external skin is alike on every locality of its surface. Its reaction is acid in the stomach, alkaline in the mouth and intestinal canal; a mucous substance is secreted from the parenchymatous substance of some organs, without the presence of cells; there are pathological liquids, as colloid, very similar to mucus; there is the substance called after the name of Wharton, in the umbilical cord of the foetus and newly born, the cellular development of which cannot be traced; and nevertheless this "gelatinous connective tissue" is transformed into mucus. Thus from an anatomical point of view the secretion of the mucous membrane is not a uniform substance; neither is it uniform as to chemical composition. I have stated that its reaction differs according to localities. It frequently contains albumen, some little fatty substance, extractive matters, and some mineral elements, as chlorides of alkalines and phosphates of earths. These mineral elements belong to the mucine, which is a nitrogenous, albuminous substance, swelling in water, but not dissolved by it, and to which the mucus owes its tough nature. Its chemical reaction differs according to its percentage of minerals, combination with other poisonous substances, or its own peculiar modifications. This difference is easily explained by the fact, that it is not preformed in the blood and thrown on the surface, but is a production of the mucous membrane itself. Thus its constitution depends on the amount of follicles, epithelial scales, papillæ, and on the character of the epithelium; no matter whether it is formed directly from the epithelium undergoing its final changes, or from transudation through the walls of the capillary vessels.

In regard to the diseases of the mucous membrane I have already stated both their frequency of occurrence and their propensities for complication. Their tendency to sickness is, however, not uniform; individuality and age belonging to those influences which are most apt to modify the alterations taking place in their tissue or secretion. Affections of the mucous membrane are very rare in foetal life, because of the absence of both mechanical injuries and functional

disorders. In infantile age the mucous membrane reaches its greatest importance, new influences acting upon it and calling into life new functions, especially the normal state of injection, which is very considerable indeed. A very common alteration taking place in the mucous membrane is mollification; plastic exudation, haemorrhage, suppuration, and ulceration, being very rare in the first year of life. After this time exudative processes are more numerous, especially fibrinous exudations are not unfrequent. This pre-disposition of early age to contract diseases of the mucous membrane, is afterwards decreasing, is not very common in advanced age, until in senile age it is rather increasing.

A number of diseases of the mucous membrane in early age are of a primary nature, and many of them result from direct local injuries. It is a singular fact, however, that thorough and deep local injuries, cuts and wounds of any kind of the mucous membrane, dangerous though they look, are attended with very little danger in the majority of cases; they will generally heal readily and lose nothing of their merely local character. Thus foreign bodies entering the substance, combustion destroying the structure of the mucous membrane, although sometimes among the causes of a disease, will not so frequently give rise to a severe affection, as a less serious injury often repeated. Animal or vegetable parasites, and indigestible food, will therefore, as their influence extends over a longer period, although their sudden insult is often but inconsiderable, be among the most frequent diseases of the mucous membrane of the digestive organs. Another very important and frequent cause of disease of the mucous membrane is refrigeration. We are entitled to state this is a fact, although we do not know whether cold acts by the suppression of cutaneous secretion alone, or by some influence on the peripheric cutaneous nerves and reflex action alone; or by both. It is, however, a fact that especially the mucous membrane of both the respiratory and digestive organs is very subject to the influence of cold, together with the other causes of disease depending on the general condition of the atmosphere, and the changes and general influence of season, of epidemics and endemics.

These latter are of great importance in the etiology of

the affections of the mucous membrane in early age ; for we know that not only malarious influences and animal effluvia will readily act on the impressible infantile organism, but the constitutional and contagious poisons are mostly observed to produce their peculiar forms of disease in infantile age. Thus children are the majority of patients suffering from eruptive fevers ; scarlatina, measles, and diphtheria, mostly attacking the infantile organism. And here it is important to state, that a peculiar part of the mucous membrane has always a tendency to be affected by a peculiar constitutional poison, both in early and advanced age. Thus diphtheria, scarlatina, syphilis, and mercurialism show a predilection for the mucous membrane of the mouth and pharynx, typhus for the ileum, dysentery for the colon, measles and iodism for conjunctivæ and nose. All such affections, although common to every age, are mostly found in the infantile period, the modes of propagation and transmission being eminently distinct at this period of life.

I have frequently alluded to many cases of secondary affections of the mucous membrane ; they are the usual results of either local propagation in the continuity of tissue, or of sympathetic spreading. We know from general pathology that there is a direct connexion between cutis and mucous membrane, scalp and nose, mamma and uterus, urethra and testicles, and stomach and brain ; we need not be astonished then, that there is a contemporaneous affection sometimes of the mucous membrane of the nose and the lungs, the larynx and trachea being free from disease ; or of the stomach and colon, the small intestines being not at all affected. And the spreading of affections of the mucous membrane on continuous tissue is so very general, that lobular pneumonia, for instance, is in all cases recognised as the termination of a catarrh of the bronchi ; and a protracted catarrh of the colon with ulceration of the follicles is known to be a usual consequence of catarrh of the small intestines. Nor is the topical propagation of affections of the cutis over the adjoining mucous membrane an exception, but the rule. The transmission of diphtheritic and other processes of the external integuments of the lips, anus, and pudenda majora, on the mouth, rectum, and vagina, are frequently observed.

Thus it appears that nothing is more natural than a uni-

versal or wide-spreading hyperæmia, changes in both quantity and quality of secretions, rupture of blood-vessels, and even neoplasms. The alterations observed in the secretions are frequently more important in relation to post-mortem epicrises, than the anatomical change of the tissue itself; for you have learned already, from a previous lecture, that not unfrequently no anatomical trace is detected in patients who have died from, or with, hyperæmia of the brain, pharynx, intestines, or cutis. The abnormal secretions are therefore as important elements in regard to the results of post-mortem examination, as they again are ready causes of renewed attacks, from the local irritation depending on their presence on the membrane. The prognosis, therefore, depends greatly on their nature and amount, and frequently as much on them as on the structure of the membrane, its epithelium, follicles, or papillæ. To a great extent they also influence the symptoms, amongst which functional disorders and anomalous secretions are always prominent. Pain is sometimes observed, but it is frequently indistinct and obscure. Of more importance than the latter, however, are some indirect symptoms, of which reflected motions, and even muscular paralysis, are frequently met with. Thus, sneezing, coughing, vomiting, and tenesmus are brought on. Disorders in neighboring or distant parts are effected by the suppression of secretion and injection of the tissues; topical spreading on the subjacent submucous tissue, as in œdema of the glottis, and retro-pharyngeal abscess; and participation of the whole system.

After these general remarks you are enabled to trace a direct connexion between even the slightest causes and severe affections. I have taken particular pains, in former lectures, to present for your inspection a number of affections which, severe though they be, owe their origin frequently to a comparatively insignificant cause. The greatest stress has been laid by me, further, on the large number of slight or important causes giving rise to affections of the mucous membrane. That in some cases an abnormal process of dentition will prove a source of evil, I do not deny; but from many previous remarks, and from comparison with other causes of disease, you have arrived at the conclusion that the vast majority of diseases of the mucous membrane

allow of another explanation than the blind assumption of the culpability of a physiological process. The great progress of pathological anatomy and differential diagnosis ought not to be lost on us. The period, where the diseases of small children consisted in dentition, of advanced ones in worms and serofula, of adults in rheumatism, serofula, and syphilis, is past. With sound principles in pathology, and a correct knowledge of pathological anatomy and differential diagnosis, all the different and numerous affections of the mucous membrane: simple injection, with or without extravasation; acute hyperæmia, with increase and alteration of the secretion, and follicular swellings; acute serous or bloody exudations, with more or less severe symptoms; pseudo-membranous deposits of epidemic, syphilitic, or mercurial character; purulent discharges; ichorous decomposition; chronic alteration of both vascularization and secretion; hemorrhage; œdema; hypertrophy and whatever changes we have learned to take place in the mucous membrane of all the organs that have been submitted to your attention in previous lectures—will no longer present to you the difficulties of bygone times, nor urge upon you the necessity of resorting to an obscure, generally erroneous and improbable, and almost always unproven explanation.

After all my previous remarks on the nature and pathology of the mucous membrane in general, a few additional words will suffice to illustrate the relation of diseases of other organs to the protrusion of teeth. For the organs of digestion are not the only ones which are said to be influenced by, and to suffer from, dentition. Many diseases of the uropoietic, sexual, respiratory, and sensory organs have been attributed to the same cause.

Diseases of the respiratory organs are very frequent in infantile age. The liability to catarrhal and inflammatory affections of the bronchi, etc., decreases, as a general rule, with the age; so much so, that their number during the time of dentition is decidedly less than before. This circumstance alone ought to render us careful in speaking of the protrusion of teeth as a cause of diseases of the respiratory organs of whatever character. The etiology in a given case is by no means unimportant; as the prognosis and even treatment depend a good deal on the causes of the affection. Among these the influences of weather, tempe-

rature, and seasons, rank very high, as is well known; a number of epidemic diseases, as morbilli, whooping-cough, and scarlatina, exhibit, too, a great tendency to complications with catarrhal affections of the respiratory organs. These affections, however, appear frequently without peculiar danger, being the direct results of the state of the atmosphere, exhibiting an epidemic character. Many other diseases are liable to the same complications. Thus rhachitis, syphilis, scrofula, and tuberculosis, are among the principal causes of bronchial catarrh and pneumonia; inflammations of a croupous character engender in the neighboring organs the liability to catarrhal affections of the mucous membrane; and pseudo-membranous croup in the larynx is often combined with bronchitis and bronchopneumonia; and even marasmus resulting from copious secretions or defective nutrition, appears to give rise to severe and obstinate catarrh of the respiratory organs, by the inspissation of the blood and by the impediment to the normal circulation.

As it is not my object to give the full pathology of the organs which have been believed to be endangered by the process of dentition, I hardly need speak of the variety of forms of catarrhal and inflammatory affections depending on the age of the patients, the seat and severity of the disease, and its primary or secondary character. In very small infants, catarrh of the bronchi is most dangerous; the more so, as not only the large ramifications will be affected, but the last ends of the air-tubes will be easily involved, when we have developed the dangerous complexity of symptoms belonging to capillary bronchitis. The severity of the symptoms, the chills, uneasiness, restlessness, thirst, cough, pain, dyspnoea, cool extremities, the local physical symptoms, and nervous affections, as convulsions, depend on the extent and situation of mucous membrane and pulmonary tissue involved in the process. Many inflamed lobuli in a single lobus will not, as a general rule, bring on the same amount of dyspnoea as the same number interspersed in the healthy tissue; cough will be more frequent in mere affections of the mucous membrane, or in the last stage of pneumonia, than in its first stage, and where the symptoms of pneumonia predominate over those of catarrh. Bilateral affections are much more dangerous than those confined

to one side; so much so, that bilateral pneumonia in very young children is an almost always fatal disease; and nervous disorders, as convulsions, are exceedingly more frequent in affections of the upper lobes of the lungs than in the other. Catarrh of the trachea and first ramifications is seldom a cause of great dyspncea; in the ramifications of the second order the alternations of the utmost dyspncea and comparative ease depend on the presence or removal of the secretion, and are characteristic of this locality; the catarrh of the capillary ramifications has been stated to be very dangerous indeed. Nasal catarrh is liable to be transmitted through the naso-lachrymal duct to the conjunctiva of the eyelids and the bulbus, especially the chronic form, depending on dyscrasie causes. Laryngeal catarrh, with its peculiar croupy cough, and hoarseness, and intense reflex sensitiveness resulting in troublesome attacks of coughing, and its frequent complications with catarrh of the pharynx, is not rarely complicated with catarrh of the Eustachian tube, and even the external ear; and all of them have a decided tendency of successively or simultaneously endangering the whole mucous membrane of the respiratory organs.

Whatever, then, I have cursorily stated on the causes and nature of catarrhal and inflammatory affections in this locality, shows that dentition is certainly not frequently to be blamed for their presence. I have here again, as in other instances, laid the most stress on the large number and variety of causes, in order to show that a differential diagnosis and exhaustive knowledge of general etiology will keep us from falling into the well known errors and misconceptions, universal in the public, and still frequent in the minds of professional men. Nor is there any connexion between dentition and the treatment of the affections alluded to, with their fever, copious secretion, dyspncea, and other symptoms. I do not see why a regular and strict diet, fresh and moist air, and uniform temperature required in the treatment of bronchial catarrh or pneumonia, should be considered as being in a direct relation to dentition; nor do I detect any between this physiological process and the febrifuges, veratria, digitalis, quinia, and antimony; or narcotics, as opium, hyoscyamus, and cannabis; or derivatives, sinapis, vesicatories, and local depletions; or ex-

pectorants of both mild and stimulant character, antimonials, ipecac, muriate, acetate, and sesqui-carbonate of ammonia, senega, camphor, benzoic acid, and others.

The catarrhal affections of the eye, and the catarrhal otorrhœa, have already been alluded to. Their etiology, and therewith the possibility, or probability, of their dependence on dentition, have been spoken of on different occasions. I, therefore, leave you to the inferences naturally resulting from all my previous lectures. The only thing, however, to which I desire to direct your attention, is the occurrence of otorrhœa in all the periods of rapid cranial development, especially in such children who from bad habits, hot pillows and bonnets, or hereditary or acquired scrofulous disposition, are liable to accumulations of an over amount of blood in the head. That in a time where the physiological development of the head closes sutures and fontanelles, raises teeth, and increases the amount of cerebral substance by a normal hyperæmia, otorrhœa should occasionally show itself, is no more wonderful than the fact clearly proven by every day's experience, that most cases will come on without serious symptoms of any kind, and gradually disappear spontaneously, no remedy having been resorted to besides cleanliness, and in some cases a gently astringent application.

At all events you perceive how little there is in that "teething through" or "over" the chest, ears, or eyes.

The urinary and sexual organs have also been said to suffer from the consequences of dentition. There are particularly three affections connected with pathological conditions of the bladder, which, in our text-books, are frequently attributed to this physiological process, viz. catarrh of the bladder, incontinence of urine, and ischuria.

Catarrh of the bladder is by no means so rare a disease in early age, as many of our authors maintain. Traumatic injuries, the presence of calculi, abuse of cantharides, and preceding diseases, such as typhoid fever, cholera, and variola, are admitted to rank amongst its causes. All those cases, however, which do not come under these heads, have very frequently been attributed to dentition, as the always ready scapegoat of a deficient diagnosis. Now, Civiale, one of the best authorities on the diseases of the urinary organs, has directed the attention of the profession

to the fact, that the muscular layers of the infantile bladder are less active than in advanced age; that the inert condition of the organ will, therefore, give frequent rise to retention of urine, and that carbonate of ammonia will, consequently, be formed in the bladder, giving rise to irritation and injection of the mucous membrane and its symptoms, viz. pain in the region of the bladder, through perineum and urethra, and the frequent and scanty emission of a dark-colored, or mucous, or bloody urine; symptoms which are sometimes even complicated with dilatation of the bladder, fever, symptoms of typhoid fever or peritonitis, emaciation, sopor, vomiting, and collapse.

The cases explained by the physiological condition of many an infantile bladder, as shown by Civiale, are by no means rare or simple. They are usually not attended with the same danger as those depending on traumatic injuries or the presence of irregularly shaped calculi; but they generally last longer than such as are produced by cantharides, and frequently prove at least as obstinate as those occurring in the convalescence from typhoid fever, cholera, or variola. Nor is the treatment always successful in a short time, or permanent, for the condition of the muscular layers cannot so readily be changed as the momentary anatomical lesion depending upon it. In the majority of cases, however, the administration of alkalies, particularly bicarbonate of soda, or in very chronic cases gallic or tannic acid, *nva ursi*, or *buchi*, will suffice to restore both the normal condition of the mucous membrane, and the normal emission of the urine.

By incontinence of urine I do not mean complete paralysis of the bladder involving both the expelling muscular layers and the sphincter. This latter affection results from a central cause, giving rise to constant dribbling of urine, both day and night. Now, by this symptom, it will be easily diagnosticated from the affection in question, which, indeed, compels children to urinate frequently during the day, but is best recognised by their wetting their beds while asleep. It is more frequently observed in males than females, sometimes up to the tenth or twelfth year. I know, indeed, cases that have lasted up to adult age. Such cases prove, without further remarks, that they need not be, and generally are not, the results of bad habits;

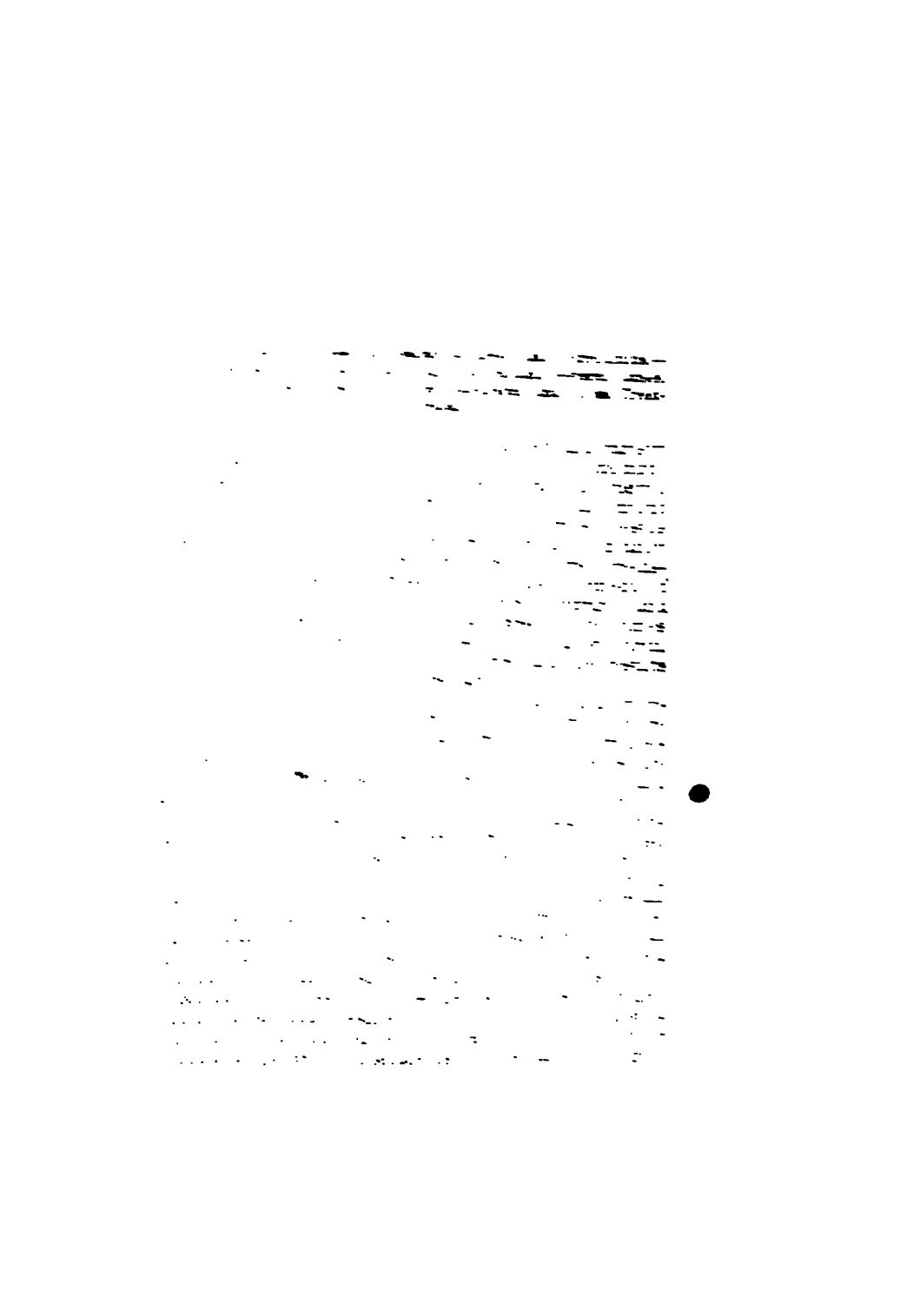
not to speak of the fact that many such cases of incontinence of urine, or enuresis, occur in children affected with manifest symptoms of scrofula, or rhachitis, without the presence of any change of the chemical composition of the secretion. As a general rule the cause of an individual case—and the etiology of the disease which interests us most here in the attempt of rightly estimating the assumed influence of dentition—must be sought for in one of the following circumstances: either sleep is too sound, and here lies the explanation of the fact that very often children will wet their beds in the first part of the night; or the perceptive power of the bladder is too little; or its sensibility is too great in proportion to the soundness of the sleep, the sensitive nerves influencing the motory ones by reflex action. The latter cause appears to be very frequent; if nothing else were going to prove this assertion, it would be upheld by the speedy success obtained in the vast majority of cases, by the internal administration of belladonna. A quarter or a third of a grain of the alcoholic extract of belladonna, given at bed-time, or two or three times a day, will cure almost every case of incontinence of urine (and, as I have found, of feces), without affecting the pupils which in the adult are the first organs influenced by this medicament, but are rarely so in children. It may be necessary to give the remedy for a week or two, in sufficient doses, but I have seen a number of cases of long duration which were speedily relieved and permanently cured by a few doses. Other cases, according to their etiology, would require the use of *nux vomica*, or the constitutional treatment appropriate to scrofula, rhachitis, or anaemia.

Ischuria, or retention of urine, is not unfrequently seen in infantile age, although dangerous cases are rare. The patients are generally such as suffer also from flatulence and colics; the symptoms attending ischuria, and those observed in flatulence, as pain, screaming, violent adduction of the thigh to the abdomen, being very similar to each other. Percussion of the vesical region, however, will frequently yield a correct diagnosis. The causes are very various, from malformations of the urinary organs, or permanent foetal condition of the kidneys, down to the presence of vesical calculi; spasm of the bladder, and

diarrhœa; or reflex action depending on constipation, meningitis, the presence of worms in the intestinal canal, and they say dentition.

Catarrhal affections of the sexual organs have also been attributed to dentition—balano-posthitis, the hyperæmia, erosions, and the over-secretion of the surface of the glans penis, which usually is the result of uncleanness only. The fatty secretion of the inner surface of the prepuce, especially where this is narrow, and covers the whole of the glans, requires constant attention, its frequent removal being the only preventative against decomposition and its local consequences. Masturbation, either a bad habit contracted by the manipulations of injudicious nurses, or in consequence of worms irritating the mucous membrane of the intestinal canal, are often among its proximate causes.

Catarrh of the vagina, rarely complicated with catarrh of the urethra, is even of more frequent occurrence than balano-posthitis; the complication alluded to being sometimes the effect of gonorrhœal infection. For the superstition of gonorrhœa being removed by the contact with an intact hymen has not yet died out entirely. Want of cleanliness, the presence of foreign bodies, as peas or beans, or oxyurides vermiculares emigrating from the rectum into the vagina, moist dwellings, liability to catarrhal affections in general, anæmia, and scrofulous or tubercular dispositions, are very frequently recognised as the direct causes of the affection; so regularly indeed, is there a distinct cause to be found, that up to this time, I have not been compelled to resort to dentition as the mysterious source of this evil. Nor is there any reason for the belief that there is a connexion between it and the above-mentioned affections.



rise to trouble in this early age. Being excessively active, and most abundant on the scalp, the secreted tallow, mixed with epidermoidal scales and extraneous matter, forms what has frequently been called an eruption—*seborrhæa*. *Miliaria* is frequently seen on infants during summer, after warm baths, in hot rooms and bedding (prickly heat). *Strophulus*, *papulous erythema*, local *pityriasis*, *nettle rash*, *roseola*, *eczema*, and *impetigo*, are frequent occurrences both in infancy and childhood. *Herpes* is occasionally observed, especially in the course of acute feverish diseases; fevers, gangrene, itch, are sometimes seen from persistent want of cleanliness; *prurigo*, *psoriasis*, *lupus*, and *carcinoma* are rare, but occasional, occurrences.

Many of the cutaneous affections, more or less common to all ages and either sex, have not been mentioned here, but enough has been said to prove the frequent occurrence of both severe and mild forms of such diseases in the infantile skin. It is but natural that it should be so. For there is no organ of the infantile body which, after having been protected from external influences during foetal life, is more suddenly called to unaccustomed action and unwonted external influences and injuries, as the skin. A fine illustration of this fact is given by what has been called jaundice of the newborn. The sudden change in the circulation of the newly born, and the irritation produced by the influence of the atmosphere, and the consequent injection of the vessels of the surface, give rise to the high red color of the cutis so commonly seen during the first short period of infantile life. Transudation of haematin will usually take place; the amount of which, and the locality of its deposits, and the normal physiological transformations (so well observed in erosions, suggillations, and haemorrhages from any cause), bring on the greenish yellow color of the skin and sclerotica of infants after the third or fourth day. Thus this spurious jaundice has given rise to the impression in the eyes of many who do not know, or have not seen, the dangerous symptom of icterus attending inflammation of the umbilical blood-vessels and pyæmia, that jaundice of the newborn is an almost necessary, and always innocent disease. In the majority of cases they are right, certainly; for this majority are discolorations of the surface brought on by the physiological

transformation of the composition and color of transuded blood, and require no treatment nor particular care, while those fortunately not very frequent cases of real icterus resist every treatment and care.

I may state here at once that hyperæmia of the cutis is the principal cause, nay the only one, of a large number of different forms of cutaneous diseases. This condition partially depends on increased action of the heart and arterial pressure, partially on lessened function of the centre of circulation, and venous obstruction. Hyperæmia of the skin may be local or general, slight or considerable. Therefore it is, that the same cause, according either to its mild or severe character, or individual impressibility, or its seat in superficial or deeper layers, may give rise to different forms of exanthems. It is, in accordance with this, a peculiarity of the infantile organism, that the character of diseases generally is in a large measure determined by the liability to hyperæmia, local processes depending on hyperæmia and exudation being greatly more numerous than in advanced life. Therefore it also happens that many cutaneous diseases, although we do not know of many exclusively peculiar to infantile age, afford quite a different appearance in this period of life, and exhibit a different course from what is observed in the same form of disease in the adult.

I have said that the same cause may produce different forms known by different names in the textbooks, and that this difference of appearance depends mostly on the seat of the pathological process—hyperæmia, or exudation—and individuality. Common to all these, however, and particularly those of the first class (hyperæmia), is this symptom, that the high color of the integument is instantly removed by gentle pressure, and restored on the pressure being relieved; while haemorrhage will not, or but little, change its color, nor exudation lose its painfulness, or swelling, or yellowish appearance, or superficial desquamation, either in larger flaps or small scales.

The causes alluded to are almost universally laid down, as high temperature, moisture, local or general irritants, mechanical injuries, etc. The process resulting from such causes consists in relaxation of the tissue, and consecutive dilatation of the blood-vessels. Thus, it is explained, that hyperæmia is the first symptom of almost all, both the

acute and chronic exanthems, before exudation takes place. And it is further explained, why, with the impressibility of the infantile cutis, almost all the acute and feverish diseases of the infantile organism, in any of its parts, are so often accompanied with some of the outward forms of consecutive local hyperæmia of the skin. The injected condition of the cheeks in pneumonia and acute diseases of the respiratory organs in general, contributes to prove this remark. Exanthematic typhus owes its name to the occurrence of local hyperæmia, either superficial and maculated, or papular in consequence of effusion. The same is observed in cholera typhoid. Erythema is frequently seen in diseases of the brain, and affections of the stomach and intestinal tract are frequently complicated with urticaria. All these forms, because of their dependency on some internal cause, have been called symptomatic, while those in which the local process can be traced to a direct and immediate influence, have been baptized as idiopathic. Thus medical terminology and memory have been inundated by a large number of superfluous and bewildering, though exceedingly learned names. I say so, because I do not believe in the retaining of such names, as for instance, erythema caloricum, erythema solare, erythema venenale, erythema traumaticum, when it is fully sufficient, and equally as scientific, both to know and to state, that the simple form of cutaneous hyperæmia, which we find convenient to call erythema to distinguish it from other forms, may be produced by *calor*, warmth, *sol*, sun, *venenum*, poison, and *trauma*, a wound.

Since the time of Dr. Simon, of Berlin, whose clear understanding and studious habits the world had to bury prematurely within the gates of a lunatic asylum, all the forms of exanthems depending on either hyperæmia alone, or exudation, have been comprehended by the term of dermatitis—*inflammation of the skin*. Although this term may not appear to be the proper one in all cases, it is certainly true, that by following his example the terminology of cutaneous diseases otherwise so complicated and embarrassing has been greatly simplified. Thus erythema, erysipelas, herpes, urticaria, eczema, impetigo, lichen and strophulus, and prurigo, are easily recognised in their anatomical and physiological differences and similarities, in

some simple hyperæmia, in some effusion either in or upon the cutis, being the prevailing element. A schematic exposition of the above views is readily understood in the following classification:

- Erythema.* Superficial acute dermatitis. Without formation of vesicles. Uniform.
- Erysipelas.* General acute dermatitis. With formation of blisters. Uniform.
- Herpes.* Superficial acute dermatitis. With formation of vesicles. Location limited. Typical course.
- Urticaria.* Superficial acute dermatitis. With formation of papulae.
- Eczema.* Superficial acute dermatitis. With formation of vesicles. Diffuse. No typical course.
- Impetigo.* Superficial acute dermatitis. With formation of pustules. Copious development of young cells.
- Lichen. (strophulus.)* Acute dermatitis. With formation of conical noduli, mostly in groups.
- Prurigo.* Acute dermatitis. With formation of small and flat, and itching noduli. Diffuse, or in groups.
- Roscola.* Superficial acute dermatitis. No effusion. Circumscribed spots.

These forms of cutaneous eruptions are, more or less, those which are by very many authors, and the public generally, attributed to the influence of dentition. To judge of the truth of such assumptions, we shall be enabled by either the affirmative or negative answers to a number of distinct questions. The nature of these answers will show if there is, in our case, any truth for the "*post hoc*," or rather "*cum hoc*," "*ergo propter hoc*." These questions are these: Is there, between the protrusion of a tooth, and the appearance of the above mentioned cutaneous eruptions, a mere coincidence, or a direct causality? Will these eruptions show themselves with the swelling of the gums? Will they disappear with or after the final protrusion of a tooth or a group of teeth? Will they return with a renewed attempt of another tooth, or group of teeth, to break through the gums? If there is a relation, which is it?

The nature and etiology of those eruptions will finally help in deciding the above questions.

Of the cutaneous affections mentioned, *erythema* is of very

common occurrence. It consists of a superficial hyperæmia of the cutis, sometimes complicated with a small amount of exudation. According to the amount of serum transuding through the blood-vessels, more or less desquamation, in very small scales, will take place, but it forms no necessary part of the affection; at all events no formation of vesicles is observed. One of the characteristics is found in the gradual transition of the healthy into the erythematous surface. The etiology of erythema is simple enough. In a large number of cases the causes are: high temperature, and chemical, physical, and mechanical irritation. Different names have been invented to suit the different forms and causes of the affection. They have called it *intertrigo*, when the case was one of erythema, produced by friction of two adjacent surfaces, near the folds of the femora, or neck, behind the ears, or near the mammae of fat women. *Decubitus* is called the erythematous discoloration of the skin depending on long continued pressure over the sacrum, trochanter, etc., in protracted diseases. *E. laeve* it has been named when the consequence of considerable expansion of the skin in dropsy, or the result of local injuries. And a very common form is that depending on the irritation kept up on several places by discharges from the neighboring organs, thus from the nose on the upper lip and cheeks, from the bladder on penis, prepuce, scrotum, and femur.

Besides, erythema is regarded as having been observed epidemically, and with cyclical course. Whether this is founded on truth, or whether or not mild cases of scarlatina or measles were mistaken for a typical erythema, is an undecided question. At all events the differential diagnosis between the several forms is sometimes a difficult one, and especially while and where both of the mentioned forms of epidemic diseases are frequently observed.

This uncertainty regarding a diagnosis is not an uncommon thing. It proves that the same anatomical alteration in the skin takes place under different epidemic influences, usually modified by the nature of the latter. Thus, for instance, there is a difference of opinion, up to this day, on the occurrence of epidemic *roseola* or *rubeola*. While some positively deny its existence, taking it as a modified form of scarlatina, or measles, or erythema, others assume its

occurrence as an independent disease taking its own course like other epidemic affections, and not at all identical with measles or scarlatina. It is said to consist of isolated and irregular spots, usually with no vascular reaction, but sometimes attended with erethic, and even inflammatory fever; to be uncomplicated in the majority of cases, sometimes, however, to be attended with a tracheal cough, and thus mistaken for measles; sometimes with angina, and mistaken for scarlatina. Neither measles nor scarlatina are said to procure an immunity from rubeola or *vice versa*, while its causes, regular or irregular migration, propagation, contagiousness or non-contagiousness, etc., remain open questions. Now these differences of opinion prove nothing else but the anatomical similarity between the large number of hyperæmic and inflammatory diseases of the skin, and the correctness of Dr. Simon's classification, and its foundation on anatomical principles.

Strophulus (*lichen* in adults) is generally laid down as the most common cutaneous affection during dentition. The exudation does not take place superficially, but into the cutis, sometimes with tumefaction of its tissue. Therefore no vesicles, but little elevations are formed. Its causes are frequently unknown. Whatever is apt to produce a single superficial erythema, may just as well give rise to an affection of the cutis itself in consequence of protracted or more intense injury; therefore coarse linen or flannel, dirt, animal parasites, and high temperature, are best known among its prominent causes. Some forms of "prickly heat" are simply strophulus. It is found either in groups, or isolated, or diffuse, of red, or normal, or extremely pale color, the latter depending on compression of neighboring blood-vessels. Simple strophulus takes a week or two to run its complete course with desquamation and full recovery, chronic cases being rare exceptions. A single form only, *lichen agrius*, which is not at all common in young children, is observed to be attended with severe itching, hyperæmia, and fever, and to be transformed in many cases into a severe form of eczema, with repeated attacks, and thickened and rigid condition of the skin. Simple strophulus requires no treatment, *lichen agrius* only the local application of cold and the administration of purgatives, baths, salves of tar and potassa, and the internal use of arsenic.

I will add the single remark, that this latter remedy ought nowhere to be used except where the cutaneous affection goes along with a great deal of infiltration and induration; in these latter cases it is invaluable.

Caillault, one of the latest authors on cutaneous diseases, comprehends under the head of strophulus all the erythematous, papular, vesicular, and pustular forms of cutaneous affections occurring during the period of dentition, which disappear in a short time, prove very itching during their course, are observed on any part of the surface, and frequently complicated with intestinal affections. Its eruption is said to be often complicated with fever, which, if true, is easily explained by either the complication or the local irritation and itching. He is not at all particular concerning the memory of his unfortunate readers; the papular strophulus alone being subdivided by him into the forms of strophulus *intertinctus*, and *albidus*, and *candidus*, and *volaticus*, and *confertus*. These subdivisions may be justified as proofs of philological learning, other authors having availed themselves of the same, or similar names, before his time, but there is one fact on which not enough stress can be laid, viz. the occurrence of this form of cutaneous hyperæmia and exudation, not only during the period of dentition, but also before and afterwards. You will find a great many cases in even newborn children, in whom the skin is particularly irritable.

As to *herpes*, which is an acute and typical disease, when observed in children, the assumption of its being a symptom of dentition is not sustained by anything. It is observed in a large number of feverish diseases, especially in intestinal affections, pneumonia, and intermittent fever; the vesicles raised are very small, superficial, surrounded by a red areola, and always found in groups.

Urticaria (hives) consists of flat and large elevations, mostly of the color of the skin. It depends on serous infiltration of the papillary layer of the cutis, and is mostly an acute affection. Its causes are in no direct connexion with dentition, adults suffering from the same affection when laboring under gastric disorders; and females, when affected with irritation of the uterus, during pregnancy, menstruation, and uterine diseases, or even during the presence of a pessary in the vagina. Other causes are: local irri-

tation by scratching, nettles, *rhus toxicodendron* and other euphorbiaceæ, some caterpillars and mollusca, fleas, mosquitoes, etc., the eating of strawberries, mushrooms, etc.; in some persons, the use of copaiva; the presence of acute gastric catarrh from whatever cause, this latter giving the impression of a severe disease. But not the protrusion of a tooth. Nor does it appear, that between urticaria as found in children, and again in adults, there is any remarkable difference, either in its external form and symptoms, or in its etiology.

It is true, as a general rule, that there are peculiarities in the diseases of the infantile skin, just as well as of other organs, and that the difference of ages even during infancy and childhood gives rise to a number of modifications in the form, color, etc., of cutaneous affections. But the pathological process itself is the very same, with the exception of the larger number of cutaneous affections in early age, and of individual differences depending on either more or less irritability and impressibility of both system and skin. By this fact we are prevented from favoring the old assumption, lately again advocated by Caillault, of "diathesis" being the cause of the differences as to the forms and natures of cutaneous affections. At the same time we are enabled to answer the questions laid before you in the course of this lecture, in the following manner—that there is, between the protrusion of a tooth, and the appearance of the larger number of cutaneous diseases, no direct relation of causality; that they do not show themselves with the swelling of the gums; that they do not disappear with or after the final protrusion of a tooth or a group of teeth, and that they do not return with the renewed attempts of another tooth, or a group of teeth, to break through the gums. Only those forms of cutaneous diseases scarcely deserving of the name, which depend on an occasional hyperæmia of the surface brought on by general feverish irritation, or the physiological injection of the blood-vessels of the head about this time, are observed during the periods of dentition. They, and the absence of correct diagnoses generally, and the frequency of skin affections in this early period of life, are the reasons of the long continuance of the old assumption of a connexion between external diseases and dentition.

To what extent this is true, I shall finally show by some more extensive remarks on two cutaneous affections very common in infantile age, viz. *eczema* and *impetigo*. They are deserving of our particular attention, for their frequent occurrence, the difficulty in removing them, their frequent returns when cured, and their real or assumed connexion with the physiological and pathological condition of the teeth, brain, and system.

You will find that the majority of such remarks as I shall have to make on the connexion between dentition and eczema, are also due to impetigo. I therefore shall speak of eczema alone, expecting to add a few words, towards the end of this lecture, on the latter eruption.

Eczema is a very frequent cutaneous disease, and again, like so many others, consists in a superficial dermatitis, serous exudation taking place on the surface of the cutis. It takes no typical or regular course like most forms of herpes, and spreads over a larger surface than herpes generally does. In this respect, it has been compared to catarrh on the mucous membrane, as in this form of disease also the surface is more affected than the subjacent tissue, the secretion being also copious and spreading considerably and rapidly. In the majority of cases the epidermis is lifted up by the exudation of eczema, and vesicles are formed; not always, however, in the like manner. In the simple eczema, *e. simplex*, or *vesiculosum*, the vesicles are of small size, and not surrounded by inflammation, and extend generally over a large surface. The contents of the vesicles are entirely clear and transparent. In the *e. impetiginosum* the contents are less transparent, more similar to purulent matter, the formation of young cells having commenced in the hitherto liquid and uniform exudation. In another form, *pityriasis rubra*, the exudation is not copious, not even enough so to form vesicles, but it will dry up soon and form scales on the hyperæmic surface. In *e. rubrum* (salt rheum) a similar process takes place; no epidermis is lifted up, no vesicle is formed, and the cutis is denuded of its epidermis, hyperæmic, and moist. In *tinea* (of the head, face, ears, lips, extremities, etc.), or *crusta lactea*, *milk crust*, the exudation is copious enough to form vesicles, the contents of which become dry and hard, and with the admixture of the epidermoidal scales and extraneous accidental

matter, form hard, and more or less thick scabs on the surface. Sometimes, also, a thickening of the subjacent cutis takes place, like the swelling of the submucous tissue in chronic catarrhal affections of a mucous membrane.

Crusta lactea, then, is a chronic eczema, and generally not universal, but mostly confined to a single region of the surface, scalp, face, lips, etc. It is almost always a troublesome and tedious affection, is very frequently observed in children, in their first year and later, and frequently believed to be directly connected with dentition. On the scalp (*e. capilliti*), the two forms, *impetiginosum* and *rubrum*, are most common. Vesicles are soon formed, but as fingers and combs will be equally busy in destroying them, they are frequently not noticed. The scalp, then, feels moist to the touch, the hair appears to be glued together, the secretion dries up, and scabs are formed, which together with new secretion, and the bundles of wet and sticky hair, prove a safe depot for dirt of any sort, and a pet refuge for lice. At the same time the cervical glands are found swelled, and even suppurating. This form of eczema, in which hard or soft, thick or thin scabs cover the scalp in the manner described, was formerly known by the name of *granulated tinea favosa*, while that form which, as *pityriasis rubra*, consisted in the formation and ejection of a large number of small epithelial scales, was called *tinea furfuracea*.

In children eczema is almost as frequent on the face as on the scalp. There, again, it assumes the same forms of *e. impetiginosum* and *e. rubrum*. Cheeks and chin appear red, have a brilliant appearance, and after a few small vesicles have been formed and broken, are moist and assume a yellowish color, beneath which the corium is found denuded and moist with serum. It is not necessary to allude to all the names formerly given to different forms and localities of this affection. It is enough to say that the same eruption will show itself on the external ear, on the eyelids, nose and lips, on the shoulders, and almost all the surface of the body, very generally complicated with swellings of the neighboring glands, and always proving, as I have stated already, either a very obstinate eruption, as far as its removal is concerned, or at all events one that is very apt to return after it has been once removed.

We shall approach our subject a little more by examining the causes of the eczematous eruptions, for the purpose of ascertaining how far we are justified in assuming a causal relation between eczema and dentition. Immediate irritation of the skin stands foremost amongst the causes of eczematous eruptions; hot temperature from whatever source, *e. caloricum*, influence of the sun, *e. solare*, and of warm baths, and frequently also after repeated cold baths, alternating with warm ones, etc. The "critical eruptions" of hydropathists, so much boasted of by busy doctors, and so much believed in by credulous patients of the "water-cure establishments," belong to this class. The embrocation of salves, especially mercurial, irritation by scratching, and the presence of parasitic animals on or within the skin, are also frequent causes of eczema. Many of the vesicles and pustules found on the skin during the presence of itch, are more due to the busy working of the patient's nails than to the direct influence of the acarus scabiei. Another cause of eczema authors are in the habit of assuming for such forms as are found especially on the lower extremities; they are the result of obstruction in the circulation of the venous blood, and but rarely found except in advanced age, i. e. those years of life in which venous obstructions are common and best known in the form of "abdominal plethora," chronic catarrhs of the stomach and intestines, and haemorrhoidal swellings of the veins of the rectum. We have to exclude this form from our list, as it is not found in infantile age. But there are other causes of eczema which concern us more than almost any others. The intimate connexion of the skin with all the other organs of the system, includes the necessity of its being directly influenced by internal sufferings of any kind; chronic eruptions are, therefore, the frequent results of constitutional affections, and eczema from such causes is a frequent occurrence. Especially such children as show an excessive liability to exorbitant deposits of fat in the subcutaneous tissue, and those affected with symptoms of rhachitis and scrofula, appear to be the proper individuals for obstinate chronic eczema. This connexion between eczema, scrofula, and rhachitis, is as frequent and sure as that between inflammations of the submucous tissue and scrofula, and between rhachitis and bronchial or intestinal catarrhs. Eczema, therefore, is an almost regular

companion of such children as have a white skin and soft and silk-like fair hair, whose bones are backward in their development, whose occiput is soft, and dentition little advanced, who suffer from bronchial and intestinal catarrh (the latter in the form either of diarrhoea or costiveness), who are cross, peevish, and fretful, show slight symptoms of convulsions while remaining in their general state of health, and sudden exclamations in their sleep, and who, at the same time, exhibit other symptoms of disorder in the organs of digestion, assimilation, and elimination, viz. large stomach, occasional colics and vomiting, and the presence of large amounts of phosphate of lime in the urine. After all, there is no doubt but that large numbers of cases of eczema depend on constitutional causes; as it is well known also, that in adult females, eczema is a frequent companion of chlorosis and other anomalies of menstrual secretion. Even hereditary disposition cannot be entirely denied as one of the causes of eczema, but we have no reason whatever, after the investigations of Hebra, of Vienna, to further believe in the presence of a "herpetic diathesis" in all such cases of eczema which appear unexplainable by either a local or general cause.

I have stated that some cutaneous diseases must be considered as merely local affections, while others are in direct connexion with internal diseases of either local or general character. That, however, dentition, as such, should be the cause of obstinate eczema, I have had no reason to say. It is true that, during the period of dentition, viz. from the sixth to the thirtieth month, eczema is a very common occurrence. Not only, however, will eczema be found before this period, and very frequently so after the third or fourth month, when improper food has had time to show its effects, and irregular development of the cranium, brain, and scalp becomes visible in a number of symptoms; but within the mentioned time fall rhachitis, and the first symptoms of acrofula. The physiological facts to which I have frequently had to resort for the purpose of explaining many symptoms attributed to dentition, i. e. the rapid development of the cranial bones and cavity together with the integuments, appear to explain why it is, that such children who suffer from hereditary or other predispositions, will suffer from cutaneous affections on those parts which are, at that moment,

undergoing the most rapid, though in itself normal, development.

The presumed connexion of eczema of the head and face with dentition, has been one of the causes why the treatment of this affection has been neglected as being useless, and its cure condemned as injurious. Not to speak of the supposed or real relation between this same affection and the diseases of internal organs, which also has induced most authors and practitioners to consider eczema of the head and face, at certain times of infantile development, as a *noli me tangere*. This is justified, as far as diseases are concerned, to a certain extent. Good observers have noticed that soon after a sudden suppression of eruptions on the scalp, acute hydrocephalus, laryngitis, bronchial catarrh, and intestinal catarrh would show themselves, while also severe cases of bronchial catarrh would get well after the extensive appearance of eczema of the scalp and face. Nobody can prove, to a certainty, the dependency of these facts on each other, but they show enough to give the impression of there being at least the possibility of a causal relation between them. At the same time it is worth while to remember, that the sudden suppression of a physiological or pathological secretion, to which the system had been accustomed for a long period, has been observed to be followed by a morbid secretion on some distant part of the organism. As a single instance I allude to the serous secretion of the mucous membrane of the intestinal tract after extensive combustion of the skin; and it may well be possible, that the suppression of an extensive and long continued secretion on the scalp may give rise to internal transudations. Thus, while I consider the majority of cases of eczema, as far as they do not depend on rhachitis and scrofula, as of a mostly local character, I am myself opposed not to removing cranial and facial eczema, but to removing it suddenly. By slowly suppressing a protracted secretion of this kind, we by no means disturb the equilibrium of circulation to any great extent.

To be complete, however, on this very important subject, I ought to add, that our principal modern authority on diseases of the skin, Prof. Hebra, of Vienna, is entirely opposed to considering cutaneous affections of this sort as anything but local. He first urges this point, that

the local remedies applied to the skin are by no means local applications only. For it is true that the skin is not only the receiving organ for a number of other diseases (syphilis, hydrophobia, and animal poisons, generally), but also, that the uninjured epidermis allows a number of medicaments, mercury, iodine, quinine, to enter the system. At all events, then, cutaneous affections are not repelled into the system, by local applications, to start again in other forms and on other places, but their effect may justly be considered a general one. Be this as it may, Prof. Hebra discards entirely all and every one of the haemato-cathartic—blood purifying—medicines, purgatives, drastics, herbs, antimonials, baryta, graphyta, sulphur, cantharides, mezereum, viola tricolor, dulcamara, Roob de Laffecteur, Larrey's Syrup, etc. The only internal medicines he ever uses are arsenic, mercurials, iodine, iron, cod-liver oil, bitters, acids, and all such remedies as would have been given in the same case, for the dyscrasick affection, no matter whether it was accompanied by a local affection or not.

I have deemed it proper to deviate a little from my subject to give in full the general views on the advisability and practicability of treatment and cure, in case of local cutaneous affections. As to local remedies used by myself in cases of eczema of the head and face, I will briefly add that they are principally alkalies, such as potassa, astringents, such as zinc, tannin, and lead, and "alterants," such as white or red precipitate of mercury; saving, however, for my future lectures on the diseases of the skin, as a subject for further investigations, the exposition of their individual indications.

On *impetigo* I have but a few words to say. Originally it is identical with eczema; but it has darker and thicker scabs, and the vesicles show white or yellowish contents. Below the scabs there is generally to be found some amount of purulent matter. I have already stated that there is a transitory development of the eczematous vesicle into the impetiginous pustule in *eczema impetiginosum*, consisting in the formation of a number of young cells in the transparent contents of the eczematous vesicles. That form in which this process commences early, and is general, is called impetigo. Therefore, it is not improper, in my

opinion, which however, I do not claim as original, to consider eczema and impetigo as one and the same affection, the number of cells that have been formed depending on the vulnerability and general condition of the skin, and general scrofulous disposition. Impetigo, together with glandular swellings and chronic catarrh, are the principal symptoms by which scrofula is identified. As this is so, the form of cutaneous affection requires greatly more than the former, a general treatment directed against the original disposition and morbid constitution. That, after all, dentition is entirely out of the question, as a direct cause of impetigo, I need not add.

LECTURE X.

Diseases of Bones, and Teething.—Principal Effects of Rhachitis.—Age at which Rhachitis Prevails.—Chemistry of Rhachitis.—Etiology.—Amount of Water in Rhachitical Bones.—Elimination of Phosphates and Lactic Acid.—Increased Elimination, or Decreased Assimilation?—Absence of Proteinous Substances, and Rhachitis.—Loss of Phosphates and Rhachitis not Identical.—Chemistry of Rhachitical Bones and of Those only Deprived of Phosphates.—Slow Dentition the Cause of Rhachitis, or Rhachitis the Cause of Slow Dentition?

ABOUT or a little after their first year, children begin to walk; such as are backward will be excused by the mother with their teething. Others commence to walk at, or soon after, the regular time, but their lower extremities, perhaps also the forearms and other bones, undergo very severe curvatures. Others walk at the right time, have their teeth when they ought to, but the sutures of the cranium do not close in time, the occipital portion of the cranium is softened, and symptoms of exudative meningitis show themselves. This is popularly believed to be from teething. Others have a somewhat compressed thorax, the sternum being prominent, the ribs flattened, and the points of insertion of the ribs at the sternum greatly swollen. This form of the thorax, commonly called "chicken breast," is also said to owe its origin to "teething." And there will be a great many cases in adults, of scoliotic or kyphotic curvatures of the vertebral column, which will, either by themselves or others, be attributed to difficult teething in infancy.

The series of symptoms and affections which I have hitherto mentioned, have certainly a common cause, but whether teething is this cause, is another question. They, together with a number of other symptoms, constitute what has been named rhachitis, or rickets, the most constant and remarkable anatomical symptoms of which are the following:—

1. Enlargement of the epiphyses of the long tubular bones.
2. Softening of the osseous tissue generally.
3. Thickening of flat bones, skull, scapula, etc.

4. Deformities resulting from mechanical causes influencing the softened bones of the chest, pelvis, vertebral column and the tubular bones. Those mechanical causes are principally, the action of the muscles, and the weight of the body.

5. Retardation of growth, in both bones and such parts as are in anatomical or physiological connexion with the bones: for instance, muscles, bloodvessels, nerves, and teeth.

6. Certain alterations, in the pericardium, lungs, and integuments of the spleen; they are partly explained by the pressure of the deformed thorax.

7. Less constant, but highly important alterations in the nutrition of brain, spleen, liver, lymphatic glands, muscles, and other organs.

Rhachitis is eminently a disease of the infantile age, and has very rarely—in truth only in a few cases, part of which are even doubtful—been found immediately after birth. The first symptoms show themselves at the age of a few months or years. A few statistical statements will suffice to give at least some information concerning the connexion between rhachitis and, particularly, beginning dentition.

Guérin found, in 346 cases of rhachitis, right after birth, 3; under one year, 98; under two years, 176; under three years, 35; under four years, 19; under five years, 10; under twelve years, 5.

Luszinsky has the following percentages:—Under six months, 13 (in another year, 20); under twelve months, 25; from one to three years, 56; from four to six years, 5; from seven years upwards, 1.

Of 1,654 rhachitical patients observed by Küttner, there were

| | Males. | Females. | Total. |
|--------------------|--------|----------|--------|
| Under 6 months | 14 | 4 | 18 |
| From 6 to 9 months | 31 | 18 | 49 |
| “ 9 mo. to 1 year | 67 | 53 | 120 |
| Under 1½ years | 193 | 165 | 358 |
| “ 2 “ | 151 | 186 | 337 |
| “ 3 “ | 215 | 234 | 449 |
| “ 4 “ | 81 | 97 | 178 |
| “ 5 “ | 28 | 44 | 72 |
| “ 6 “ | 13 | 11 | 24 |
| Over 6 years | 21 | 28 | 49 |

The largest proportion of cases occur in the second year, after the protrusion of teeth has fairly commenced. The first weeks of life are almost exempt, but there have been described cases of not only early, but even foetal development of rhachitis. Under eighteen months, the male sex appears to yield the larger number of patients, while towards the close of the second year and later, the female appears to be more affected.

Extensive chemical investigations have led to the following results; that the general chemical character of rhachitical bones consists in too small an amount of the earthy salts. It is least during the height of the process, the remaining portions of the old tissue being more similar to the normal condition; the new formed "osteoid" parts, however, showing the greatest deviations. In these the amount of carbonic acid is also increased. The percentage of fat shows very little difference indeed, with the exception of the long tubular bones, in which a large amount of fat is found in consequence of medullary substance being found both in the spongyous part of the bones and the dilated medullary canal. The specific gravity of rhachitical bones is generally diminished in proportion to the intensity of the process. The organic basis of the tissue has undergone no essential alteration, but the non-ossified cartilages have increased their proportion of water. The old question, whether the rhachitical bone yielded chondrin like cartilage, or gluten like bone, has finally been answered by the discrepancies of opinions being explained by the different and partially defective modes of inquiry. There is gluten, not chondrin, in the rhachitical bone, which therefore ranks, not among cartilaginous tissue, but at the side of normal bone; while at the same time the increased amount of carbonic acid found in the recent rhachitical deposits places them side by side with the normal physiological process of growth.

As principal causes of rhachitis, many authors have considered either diminished introduction, or impaired assimilation, or increased elimination of phosphates. That the former assumption cannot be sustained is proved by the large amount of phosphates contained in almost every one of the articles of food in common use. Impaired assimilation depends on a diseased condition of one or more of the digestive organs, which, it is true, are always found dis-

ordered in a certain stage and development of rhachitis. Increased elimination of phosphates through the urine, according to Kletzinsky through the feces also, is generally found to take place, but not always. Exceptions have expressly been stated—for instance, by Dr. Friedleben, who has found a number of instances of well marked rhachitis with no increase of the amount of phosphates in the renal secretion. He, moreover, points to the fact, that the presence of a surplus of phosphates in the urine, when proved, may just as well be the consequence as the cause of the rhachitical process. For, certainly, where ossification is prevented from taking place normally, the phosphates are to be removed somehow from the blood in which too large an amount of them is contained.

Altered condition of food, particularly want of proteinates, and disorders in one or more of the important digestive organs, at a period of life in which the organism requires much and appropriate new material, are the prominent first causes of rhachitis. At the same time all such diseases and disorders which may lead to impaired assimilation and nutrition will help in bringing on rhachitis. Thus Dr. Friedleben lays particular stress on the importance of early diseases of the respiratory organs. It is true, that almost all the post-mortem examinations of rhachitical children have yielded collapse, induration, or atelectasis of the pulmonary tissue. These alterations must not be explained by the pressure of the abnormally curved ribs and costal cartilages, for those alterations are frequently found where there can be no pressure from the ribs; and experience teaches, that even the most acute processes, like pneumonia, will result in depressions and irregular configurations of the thorax. Thus in many cases not the rhachitical process of the ribs, but the morbid condition of the lungs, must be taken as the original source of asymmetry, depression, and narrowness of the chest. The frequency of pulmonary or bronchial affections, before or during the rhachitical process, appears to justify the assumption of a direct connexion between them; any serious either acute or protracted affection of the respiratory organs, necessarily involving an impaired condition of the blood from which every new tissue is to be formed. Just add thereto insufficient food wanting in proteine, narrow room, over-crowded popula-

tion, bad air, and careless nursing, and you will no longer wonder at the combined result showing itself in the abnormal growth of the infantile cartilage and bone.

The anatomical structure of both the normally growing and the rhachitical bone is the same ; further, the amount of carbonic acid is increased in both the new deposits of the growing and in the rhachitical bone. Thus the direct connexion between, or dependency on each other, of the normal development and the rhachitical deformity of the osseous tissue is evident.

The principal deviation of the chemical constituents consists in the increased amount of water. Friedleben found in the healthy parietal bone of a child of six months 21.058 per cent. of water ; in the rhachitical parietal bone at the same age, from 48.383 to 53.574 per cent. ; and in that of a rhachitical child of eight months, as much as 81.533 per cent. The occipital bone of a child of a year and two months, with normal skeleton, yielded 41.931 per cent. of water, while the parietal bone of a rhachitical child of the same age yielded 66.314 per cent. in the recent deposits, the old subjacent lamina vitrea yielding but 34.221 per cent. The same author found in the normal diaphysis of the tibia of a healthy child of six months, 21.323 per cent. of water ; of a rhachitical one, at eight months, 44.790 ; in the spongyous part of the former, 64.037 ; of the latter, 76.912. The same bones of children of a year and two months, one healthy, the other rhachitical, yielded a similar proportion, viz. 43 and 72 per cent. The normal ribs of a child of six months contained 44.305 per cent. of water, the rhachitical, 54.809. In other children this percentage would increase to 59.64, and even to 66.105.

The increased amount of water contained in the rhachitical bone forms a sort of serous mollification, which in itself may be sufficient to prevent the cartilage and newly formed bone from assimilating as many phosphates as under normal circumstances. For it appears, doubtless, that with so considerable an amount of water contained in the osseous and cartilaginous tissues their chemical affinity generally should be changed. At all events an older hypothesis, of the rhachitical bone being deprived of a part of its phosphates is very improbable. Many authors have expressed this opinion, that the phosphates were kept dissolved in

the blood by a super-abundance of lactic acid, and were, in company with the latter, eliminated through the kidneys and bladder. A part of the chemical investigations which have been made for the purpose of elucidating this subject, have appeared to be favorable to this opinion, as not only lactic acid, but also a large amount of phosphate of lime, have been found in the urine of many rhachitical children. But in order to explain the want of phosphates in rhachitical bone, in this manner, the presence of phosphates and the occurrence of lactic acid in the urine of rhachitical children ought to be constant; which it is by no means in all cases. Rhachitis will very often appear without the prevalence of disorders of digestion and a surplus of lactic acid, and surely, the swelling of the epiphyses and periosteum, which are just as essential for the diagnosis of rhachitis, cannot be explained by the premature elimination of phosphate of lime. Virchow, moreover, has long ago expressed the opinion, that probably the diminished import of phosphates was of more importance in the rhachitical process than the augmented export. At the same time he directs the attention to the repeated eulogies of the administration of carbonate and phosphate of lime, in rhachitis. He also reminds us of the fact, that the larger part of phosphates are introduced into the system in combination with proteinous substances, and the digestion and assimilation of these latter are greatly interfered with in those gastric disorders, which frequently precede fully developed rhachitis. But again, he asks, why is it that gastric disorders are not always the initiatory step of rhachitis; that further, the bones should suffer in preference; and finally, that, in spite of diminished import, the epiphyses and periosteum should be tumefied. Therefore, we need not wonder that other authors, for instance Niemeyer, consider as the fundamental cause of rhachitis, a nutritive disorder in the epiphyses and periosteum kindred to inflammation. This author points to the fact, that in other tissue, as skin and mucous membrane, we frequently meet with diffuse affections of exanthematous or catarrhal nature, the causes of which are totally unknown to us, but which, though not constantly, are principally found in cachectic, badly nourished, and rhachitical children. And that, after tumefactions have once commenced, the impeded

circulation should prevent the phosphates from being deposited to a sufficient amount, and favor their immediate elimination through the kidneys; that therefore the usual superabundance of phosphates in the urine of rhachitical children must be taken as consequence rather than as cause of the want of phosphates in the diseased tissue, is but natural; especially after those remarks I have made before, on the influence of the increased amount of water in the osseous and cartilaginous tissue.

To what extent Virchow is right in directing our attention to the connexion between rhachitis, which is very common among the poorer classes of society, and the absence of proteinous substances from the food, either breast-milk or artificial, is shown by everybody's and everyday's experience. Böcker found in the milk of a mother, who nursed a rhachitical child until it died at the age of fifty-three days, in 1000 parts, but 13.111 of caseine, 23.31 of butter, 60.358 of sugar, and only traces of phosphates to the amount of 0.089. Friedleben has, in his "Contributions to the knowledge of the physical and chemical constituents of growing and rachitical bones, in early infancy," the following remarks:—I examined the milk of two women, whose children were brought up with breast-milk exclusively. The skeletons of both were rachitical in their totality; both recovered, but only after their diet had been changed. One was a turgid, pale woman, of forty-six years, who had been bled several times during her pregnancy. Two specimens of her milk were examined, the first in the fifth, the other in the sixth month after the birth of her child. The analysis yielded, in 100 parts, in

No. 1.

Water, 87.829.
Butter, 4.390.
Caseine and sugar, 7.542.
Inorganic matter, 0.239.

No. 2.

Water, 87.830.
Butter, 4.390.
Caseine and sugar, 7.542.
Phosphate of lime, 0.069.
Alkaline salts, 0.169.

The milk of the other woman, four months and a half after the birth of her child, looked thin and serous like that above. Since her confinement, being at work and without medical attendance, she had been suffering from uterine haemorrhages. She was tall and slender, and nearly forty years

old. The analysis of her milk resulted in the following figures. In 100 parts of milk there were,

| | |
|---------------------------------------|---------|
| Water, | 91.307. |
| Caseine, butter, sugar, | 8.509. |
| Phosphate of lime, | 0.099. |
| Carbonate of lime, | 0.010. |
| Alkalies, | 0.073. |
| Oxide of iron and silicium, | 0.002. |

The normal proportions in the healthy milk, not to speak of constitutional and other variations, differ considerably from the above, as is proved by the following figures of the several percentages of normal milk:—

| | |
|----------------------------|--------|
| Water, | 86.60. |
| Caseine, | 3.50. |
| Sugar, | 6.20. |
| Butter, | 3.50. |
| Soluble Salts, | 0.06. |
| Insoluble Salts, | 0.14. |

From these statements it follows, that the milk of both women was below the average rate of proteine and hydrates of carbon. The earthy salts were also diminished, but they were fewer in the first case than in the second, while the rhachitis of the second was more decidedly developed than that of the first. Nothing else is required to prove, that the diminished import of phosphates is neither the only nor the principal cause of rhachitis.

At all events then, this much is understood now, that there are other important elements in what we have been used to call rhachitis beside the diminished amount of phosphates; and that want of phosphates, and rhachitis, are by no means identical. Nor is the very nature of rhachitis explained by, or comprehended in, the process of resorption. This is best shown by those physiological experiments which allow a free absorption, but less access of earthy salts and phosphoric acid. Chossat has made the first series of such experiments. Friedleben made similar ones, allowing a number of pigeons no other food but vetches and distilled water. Through five or six months they appeared to be well; then diarrhoea would set in, emaciation take place, and death from exhaustion ensue in

the tenth month. The chemical analysis of their bones, compared with those of healthy pigeons, resulted in the following figures:—

| Pigeon. | Bone. | Anorganic matter. | Organic matter. | Fat. | Carbonic Acid. | Spec. gravity when dried at 86°8'. | Spec. gravity when dried in open air. |
|----------|---------------------------|-------------------|-----------------|--------|----------------|------------------------------------|---------------------------------------|
| Healthy | diaph. humer. | 64.603 | 35.397 | 7.110 | 8.571 | 2.692 | 1.822 |
| Diseased | diaph. ulnae et radil. | 37.712 | 62.288 | 12.084 | 6.842 | 2.038 | 1.762 |

A further difference was this, that jelly could be formed of the bones of the healthy pigeon in eleven, of the diseased in five minutes. Thus, as gluten was the organic basis in either, the chemical constitution of the diseased bones, as far as organic matter was concerned, was not at all altered. But there were a number of other differences between this diseased bone, and the rhachitical tissue. The amount of earthy salts decreased to nearly one-half of the normal percentage; fat increased; specific gravity was less. Carbonic acid twenty-five per cent. less than in the bones of the healthy bird. No tumefaction of epiphyses or periosteum. These results depend on diminished assimilation, which, moreover, is distinctly proved by anatomical examination of the diseased bones. They are thin, fragile, not flexible; they are anaemic, and their medullary canals very large indeed; the surface is uneven; there are intervals, interruptions, between the remnants of the bone and the dispersed osseous corpuscles, which are much less numerous and less regular than normal, to such a degree that Haversian canals between them are not recognisable. There was nowhere a trace of recent formation, only the proofs of normal absorption.

Now, after having sifted to some extent whatever is known to this very moment on the anatomical and chemical nature of rhachitis, the most recent results included, and alluded to the usual alleged causes of this disease, I need hardly return to my former assertion, that dentition as such, and rhachitis, are in no causal relation to each other; at all events there is no such connexion between

the two that the process of the protrusion of teeth could produce rhachitis. Not to speak again of the want of phosphates alone not constituting rhachitis, the amount of these salts slowly assimilated for the formation of some teeth is very small in proportion to what is contained in the food. But surely, the largely diminished amount of phosphates introduced into the system (not only into the stomach), which is the result of the rhachitical process, well explains the slowness with which the teeth form and protrude in rhachitical children, and the simultaneous retardation of walking, and the slow ossification of bones generally. At another place, and in a former lecture also, I have spoken at some length of these matters. Thus we need not wonder that a rhachitical child who has no tooth at a year or later, cannot walk at the normal period, nor that its cranial sutures and fontanelles are not closed before the second or third year. But these latter anomalies do not depend on the retardation of the appearance of teeth, but all of them—retardation of the closure of the cranial bones, retardation of walking, and retardation of the protrusion of teeth—all of them are to be considered as the contemporaneous and co-ordinate results of the same fundamental morbid process.

LECTURE XI.

Dental Fever.—Fever Theories, and their Relation to Dental Fever.—Severe Fevers never Dental.—Dentition and the Nervous System—Frequency of Diseases of the Nervous System in Infantile Age—Comparative Anatomy of the Infantile Cranium and Brain, Weights and Measures.—Physiological Conclusions.—Physiological and Pathological Hyperemia of the Brain.—Liability to Convulsions decreasing with Age, —Various Causes of Convulsions.—Dental Convulsions.

THERE are, gentlemen, two systems of the infantile organism, of which I have not yet spoken to you in regard to their connexion with dentition. These are the circulatory and the nervous systems. They are subject to a large number of aberrations of their functions during the time when teeth make their appearance. As, however, the morbid symptoms observed in the nervous system, particularly convulsions and paralysis, require a thorough and explicit investigation of their own, I now, at the commencement of this lecture, shall be satisfied with making a few remarks on an anomaly of the circulatory system, very common at the period of life and development which forms the subject of these lectures. I speak of fever, which in the period of dentition, as in other ages, is characterized by ill feeling, chills, thirst, dryness of skin, frequent action of the heart, and increased temperature.

Some of the prominent symptoms by which we diagnosticate fever, belong directly to, and depend upon the circulatory system. Therefore, I prefer speaking of it as a separate subject, although the proper place would have been among the affections connected with anomalies of the nervous system. For, whatever causes may be brought forward as giving rise to fevers of any sort, it is true that to obtain a real explanation of its nature in general, and the fever of dentition in particular, we have to look for the nervous system to give it. The first reason for this assertion is the fact that every one of the fever theories of our pathologists falls back on the nervous system; and the

second, that there is scarcely any possibility of explaining the fever of dentition, which is said to be such a very common occurrence, except by taking in regard some affection of the dental ramifications of the fifth pair.

How can any affection of the dental nerves result in fever?

A few remarks on the nature and causes of fever in general will explain to you the modus of this process.

There are two principal symptoms constituting the essential features of fever, viz. increased temperature, and increased loss of substance; both prove the acceleration in the transformation of substance. The increase of temperature is particularly worthy of notice; for the utmost physical exertion, under physiological circumstances, will scarcely ever augment the temperature of the body by more than a single degree. Nor is always a dissolution of the blood, a poisoning of the blood as it were, necessary to explain the height of temperature; for there are a large number of fevers in infants and children, of very short duration, and without any serious consequences, that nevertheless are attended with an increase of four or five degrees, which by no means depend on poisoning of the blood, nor on important inflammatory processes. These latter, with all the increased combustion during their course, show more fever, and higher temperature, before their complete development, than while the inflammation as such has been diagnosed. The first assault of an inflammatory disease is generally the period of the highest fever and temperature.

Which, now, is the cause why, under all circumstances, combustion is kept down on a certain average, and chemical decomposition of the tissue into more simple combinations does not take place? And which again are the causes of such disturbances as constitute the nature of fever, with its increased combustion and disorganization?

Physiological researches have shown that the order and regularity of the functions of many systems depend on the normal action of certain portions of the nervous system. Cut the pneumogastric nerve, and the action of the heart is accelerated until paralysis takes place; the splanchnic nerve commands in a similar manner the abdominal viscera, the sympathetic nerve the action of the salivary glands; the cerebellum dominates voluntary motions, and

disturbances in its composition or function render them irregular; consciousness and thinking are rendered flighty, irregular, impossible, by more or less severe interference with the substance of the large hemispheres. Now, in a similar manner as the action of the heart, the salivary glands, the abdominal viscera have a regulating power in the normal action of certain nerves, the normal transformation of matter and combustion are considered to depend on a nervous centre, which when interfered with, and losing its regulating power, or paralysed, will give rise to the symptoms of fever. Such at least is the theory of Traube, Virchow, and Bernard, that all the vehement symptoms of fevers are the result of nervous paralysis, the only active condition (that is, irritation) being shown in the chill, the reaction, however, being the result of weakness or exhaustion of the vasomotor nerves of the whole surface of the body. By this theory we obtain an explanation of the rapid rise and disappearance of fever, and its liability to unexpected and rapid returns; further, of the considerable increase of temperature shortly before (even after) death in many diseases; and, although the rhythmical and cyclical nature of fever in general is not fully explained by it, we reach some clue to our explanation in the rhythmical and cyclical nature of many physiological and pathological processes depending on the nervous system, as for instance, sleep, many cases of neuralgia, and epilepsy.

Thus, the nature of fever would consist in the exhaustion or paralysis of the vasomotor nerves. How will this exhaustion be brought on, and in which connexion have we to assume an irritation of the dental nerves of teething children, with such an exhaustion of vasomotor nerves? Scarcely any other condition besides irritation, can be imagined to exist in those nerves, during the increased afflux of blood to the gums and jaws, and the slight hyperaemia and pressure of the nerve depending thereon. And certainly, we are not disposed to think that the immediate result of irritation of the dental nerves could be reflected to other nerves, directly and immediately, as paralysis. We are more prone to assume that if there is a connexion between the dental and the vasomotor nerves, the irritation of the former will be reflected as irritation in the latter. But then, to produce fever, you need, according to the

above stated theory on fever, not irritation, but exhaustion and paralysis. I know you will tell me, that I have stated myself, that the above theory assumes a state of irritation on the first day of fever, the chill—and will perhaps conclude that this initiatory irritation, or active condition of the vasomotor nerves, is followed, as its immediate effect, by exhaustion and paralysis. And thus, there would be no link missing in our argumentation. But there is a strong argument against this explanation. It is this, that there is a vast difference between the principal symptoms of fever in adults, and in infants and children. There is very little, or no chill, in the fever of infants, and while, for instance, cyanosis is a very common occurrence, and vomiting is not an unfrequent symptom in the most trivial fevers of children, those above mentioned principal constituents of fever, chill and reaction, are generally not observed to alternate so regularly in infants as they do in adults. Thus, the stage of irritation of the vasomotor nerves, which would have to be followed by exhaustion, and which would constitute the next and immediate result of reflexaction transmitted to the vasomotor nerves from the dental ones, does not exist at all, at least not in the vast majority of infantile fevers of any description.

Now, Professor Schiff, of Switzerland, has lately brought forward, supported by both experiments and observations, a new theory on fever, which appears to greatly facilitate the explanation of our subject. He takes the chill and the heat in fever to be entirely independent from each other. The heat, which has been taken as "reaction" before, he considers as the only constant and indispensable symptom of fever. He has further discovered in the vasomotor nerves, both contracting and dilating fibres. Therefore, where in cutting the entire vasomotor nerve, the dilating fibres are paralysed, there is no congestion; where there is irritation of the dilating fibres there is congestion, even local cyanosis; therefore, not only the chill in fever, but also the stage of heat, formerly called reaction, are active conditions; the chill depending on the action of the contracting, the heat on that of the dilating fibres of the vasomotor nerves. Thus we approach an explanation of the fact, first, why it is possible that chill can be absent, as a rule, from the fever of infants and children, although they parti-

cipate in all the other symptoms of fever of adults; secondly, that the irritation of the dental nerves may be reflected, as such, to distant nerves, and produce the symptoms of fever, without chill, by active dilatation of certain fibres of the vasomotor nerve. Thus you have another instance, where physiology has to come to the rescue in the solution of difficult pathological questions, and a proof that wherever there is an uncommon degree of hyperæmia of the gums and jaws, and consecutive irritation of the corresponding nerve, the popular belief of fever depending on the development, or rather protrusion, of teeth, is founded on some physiological truth.

But at all events you must never forget that the range of health is wider than is sometimes assumed. Tissue generally, and bloodvessels especially, bear a certain amount of injection without exhibiting any symptoms of feverish reaction, or other diseased function. Thus you would be greatly mistaken if you took the occurrence of fever during the protrusion of a tooth to be a necessary symptom. A physiological process does not include, from necessity, a pathological consequence. Thus you have to be careful in judging of a case of fever in a teething infant. If there is a difficulty in diagnostinating pathological conditions of the infantile organism, it consists in the explanation and localization of fevers. For almost every fever in infantile life will yield a local cause to an attentive observer; even such fevers as are frequently not shown by anomalies in internal organs, in adults, catarrhal fevers for instance, will be attended in children with decided symptoms of catarrhal nature on some one of the mucous membranes, and recognised as such. I always return to my old assertion, that the diagnosis of infantile diseases is by no means more difficult than of those of adult life; but care and attention, and close observation and accurate knowledge are required.

Even if the fever of a teething child is to be taken as dental fever, in a given case, it must be considered as corresponding with the amount of irritation of the dental nerve. If this is abnormal, there is no longer a physiological process, but a disease which must be diagnosticated and attended to. Severe fevers during teething ought never, never, to be taken as simple symptomatic fevers, but their cause sought for. You know, however, from a

former lecture, that diseases of the gums and jaws are rare occurrences. Thus you will have to look among the whole number of such diseases, as I had the opportunity of describing to you in these lectures, or others hitherto not mentioned, for an explanation of the untoward symptom. Again I say, where there is a high fever do not put it down as dental; mild cases, moreover, will seldom be brought to you for advice; and thus, you will seldom be called upon to make the diagnosis of dental fever. I have made the diagnosis of difficult dentition and dental fever once in the last three years. The infant suffered from a severe fever without apparent either local or constitutional causes; two days after my diagnosis the infant had variola. Since that time I have mostly left the diagnosis of dental fever and difficult dentition to mothers, and have made one of my own.

The nervous system of children has hitherto been the subject of our consideration, inasmuch as the circulation of the blood is influenced by it. It is, however, but just that we now consider it not only in that light, but also in relation to its other functions. This is an important and not very easy task; not very easy, as the morbid conditions of both its anatomical structure and physiological actions frequently resist a successful investigation; very important, from the very frequency of cerebral and other nervous affections of a more or less severe nature. Mauthner asserts to have observed 1747 cerebral diseases in 15,836 cases of sickness in children. According to Dr. Forsyth Meigs, there were in Philadelphia, in the course of five years, 3,970 deaths in children from diseases of the brain, 4,204 from diseases of the digestive organs, and 3,376 from diseases of the respiratory organs; and West remarks, that of 16,258 deaths resulting from diseases of the nervous system, in London (1842 and 1845), 87 per cent. were observed during the first five years. These are deaths. Only long-continued statistical reports on the occurrence of nervous diseases and functional troubles, not followed by a fatal termination, could give a correct idea of the numerical prevalence of such affections. The number of deaths, however, is already so large, that as not only material organizations but also functional disorders of the brain, spine, and nerves, are frequently observed, the percentage of nervous affections, both fatal and not, is enormous. As to material changes of the

substance of the nervous system, it is true that many diseases of adults are not, or rarely, found in early age, for instance, carcinomatous and sarcomatous degeneration, certain forms of encephalitis, etc., but there are a number of prevalent forms by far more frequent in children than in more advanced age. Amongst these latter, I count anomalies of the amount of blood contained in the bloodvessels of the nervous system, particularly its centres; meningitis in two forms, both genuine and tubercular; apoplexy; hydrocephalus; and also hypertrophy. Mere functional disorders, that is, such diseases of which with our limited means of investigation, and narrow knowledge, we have not been able hitherto to find the anatomical foundation, are also frequent. I need but allude to the frequency of convulsions in infantile age, which in a large percentage of cases will pass away without apparently leaving behind themselves any serious consequences.

I have stated that our knowledge of the more minute anatomy, and also the physiology of the nervous system, especially in its anomalies, is still very limited; nevertheless, those facts which anatomical researches have pointed out, will lead to the conclusion that the prevalence of nervous diseases in early age, is readily explained by the nature of the infantile nervous system. This is principally true as far as the brain and skull are concerned, as the spine and nerves, being less amenable, have been less closely studied. The anatomical facts to which, before entering into the discussion on the connexion of dentition with nervous affections, I desire to direct your attention, belong principally to the condition of the cranial bones and the cerebral substance.

In the newly-born ossification has made most progress in the auditory bones, labyrinth, portion of the petrous bone, and lower maxilla. The frontal bone still consists of two halves, its tuberosities are prominent, and no frontal cavity has commenced to be formed before the end of the first year. The occipital bone consists of four parts, the sphenoid of three; the parietal bones have not yet acquired their quadrangular condition, have as it were a fibrous appearance, and prominent tubera. The temporal bone is still divided into four parts (the petrous, mastoid, and squamous portion, and the annulus tympani); the ethmoid into three,

with very few traces of ossification. There is still, in the upper maxilla, a sign of the presence of the intermaxillary bone; the maxilla containing the alveoli for two incisors, the canine, and two molar teeth, and a distinct but very small antrum Highmori. The palate bones are low, little developed, but consist already of a single piece. The inferior maxilla is divided in two halves, and contains the twelve central alveoli. In the upper and lower dental alveoli there are already the gelatinous germs of the twenty temporary and the first four permanent teeth.

The cranial bones are kept in connexion by sutures and sutural cartilage, this latter being the remnant of what has surrounded the cranial cavity in early foetal life; the peri-cranium adhering more tightly to them than to the bones themselves. The large quadrangular fontanel, formed by the coronal and sagittal sutures, is large, of the size of a square inch and more, larger in large heads, smaller in small, and of enormous extension in hydrocephalic ones; the normal period of its closure being from the thirteenth to the fifteenth month. After this age it is found open in rhachitical children; that persons in advanced life should have an open quadrangular fontanel, is an excessively rare occurrence. A few cases of this anomaly have been given in my essay *on the premature closure of the cranial sutures and fontanel, and its etiological and prognostic importance*, and an additional one has come under my notice a short time ago, in a young man whose fontanel still had been pulsating at the age of twelve years. The triangular small fontanel formed by the sagittal and lambdoidal sutures is closed in the mature child, as well as the lateral ones. Additional ones are rare, and then are only the results of ossification having commenced from a number of supernumerary points. The peculiar undulated shape of the sutures, or rather the margins of the cranial bones, is but gradually transformed into the dentated form, which is the common appearance in later life, after the third year. Real ossification will not commence before the twentieth year, and then first on the inner side of the cranium. Congenital or premature ossification of the sutures, or even simple closure, gives rise to serious consequences. Unilateral premature closure interferes with the symmetrical development of both skull and brain; if universal, it suppresses the normal growth of

both. Microcephalus and idiotism result therefrom, or at least, from the brain being compressed, anomalies of the cerebral functions will be the consequence. Epilepsy or paralysis, naturally incurable, will follow. Or, in milder cases, the constant pressure on the cerebral substance will, by itself, or in the course of inflammatory or feverish diseases, bring on cerebral symptoms which, from the nature of the complication, will be seldom suppressed, and generally prove fatal. Perhaps the indistinct knowledge of this fact has induced old authors to call the Wormian bone, contained in a supernumerary fontanel of the frontal suture, from its apparently giving more room to the anterior portion of the brain, by the name of, not only interfrontal, but also anti-epileptic bone.

The head of the newly born has an irregularly round shape; its height amounts to about the fourth part of the length, its weight to about a fifth of the weight of the whole body. Its principal diameters are these: Four or five inches from occipital to frontal, three and a half or three and three quarters between the two parietal bones; five or five and a half from occipital bone to chin, three and a half from forehead to chin; its longest circumference is from fourteen to sixteen inches; its shortest, over the vertex, ten and a half to eleven inches. Its greatest width falls a little below the two parietal protuberances. The bones of the cranium are more injected with blood, bluish, and are more easily inflected than fractured; it predominates over the face. The frontal and parietal tuberosities are prominent. The upper margin of the parietal bone stretches in an almost perpendicular line above the lower one. The occipital bone lies more horizontally. The points of insertion of the muscles are less developed; nor are the superciliary arches very distinct; they are formed with the development of the frontal sinuses, whose first beginning dates from the second year, but which scarcely are worthy of the name before the tenth. The hair covering the scalp is short, thin, and often copious, the aponeurosis thin. In proportion to the general growth of the body, the face gradually commences to predominate, the basis of the cranium growing fastest: mostly so in its posterior portion, together with the rapid growth of the occipital bone before the fifth year, while between the fifth and tenth year, in the period of the pro-

trusion of the posterior molar teeth, the anterior portion develops at a more rapid rate. Gradually the frontal bone appears flatter, for several reasons; for its superior margin ascends; its inferior one is drawn anteriorly by the gradual prominence of the superior maxilla; and the formation of the frontal sinuses helps to bring on the same result. The occipital bone loses by and by its horizontal position, by becoming more perpendicular.

After all, the several parts of the head do not grow at the same rate. The parietal bone has its full circumference at four years, while the frontal bone still continues growing. For this reason, the parietal portion of the large hemispheres of the brain is soon left behind by the anterior frontal lobe. The cranial cavity of the new-born is about a fourth or a third of that of adults, but already in the second year grows from 482 cubic centimetres up to 999, while the weight of the skull at that period reaches already three times the original amount. The occipital portion of the cranial cavity is very small in the newly born, being only 5 per cent. of the whole. The frontal portion is as much as 13.89, the parietal 81.11 per cent. But as early as the second year, both the occipital and the frontal vertebrae grow each by 0.5 per cent. All these facts you will find to be in strict correspondence with the remarks I shall have to make on the relative development of the single portions of the brain.

1. The dura mater adheres tightly to the cranium, in infantile age, partly by means of blood-vessels, and partly by conglutination with the sutural cartilages. In the newly born it is loosely attached opposite the parietal tuberosities. It is firmly adjacent to the cerebral surface, strongly injected, bluish, and transparent. With advancing age it gains in solidity, but loses its transparency and injection. The arachnoid membrane and pia mater are very thin, colorless, transparent, and fragile; they show large veins filled with dark blood; there is a good deal of cerebro-spinal fluid, but no Pacchionian granulations are observed. The choroid plexuses are of a similar nature to that of the meningeal membranes; they are delicate, and contain more blood. All these facts constitute just as many differences from the condition in which the same parts are found in more advanced childhood, in adults, and in senile age.

The brain shows a lower degree of development. Its substance is less white, more transparent, and of a reddish-greyish color. It is of almost gelatinous consistency, at all events much less solid than in advanced age, and the separation into medullary and cortical substances is less distinct. Only some parts excel by their proportionate hardness and their white color, *viz.* medulla oblongata, corpora quadrigemina, corp. mammillaria, thalami, and pons Varolii. The fibrous appearance of the large hemispheres is not yet recognisable; the gyrationes are thicker, less prominent, and fewer. The lateral ventricles exhibit less serous contents, and their walls are more even. The substance of the brain, finally, contains but little serous blood; only near the borders of the thalami there are a large number of bloodspecks.

Not only are these general differences between the brain of the infant and the adult recognisable in every specimen, but there are some which are of quite a specific anthropological importance. The relation of the several parts of the brain to each other changes according to age, as is well proven by accurate measurements, and weighing. The relative weight, for instance, of the large hemispheres, and the occipital portion of the brain, are particularly instructive. According to Huschke the cerebellum of the newly-born weighs 25 grammes, that of the adult from 180 to 193 grammes; that is, seven or eight times as much as the former. The large hemispheres of the newly-born weigh 300 grammes, those of the adult from 1200 to 1400, that is, four or five times as much as the former. The percentage drawn from the foregoing are these:—In the newly-born the cerebellum weighs 6 or 7 per cent., the large hemispheres 94 or 93, of the weight of the entire brain. Already after seven or twelve weeks these figures have been found to vary; the percentage of the cerebellum increasing to 9 or 11 per cent. At ten or fifteen years it has been found to be 12 or 13, nearly as much as in adults, where the percentage of the cerebellum is 12 or 14, of the large hemispheres 88 or 86.

* A few other percentages are given by Huschke, *viz.*—
Male foetus of five months, 5.14; female foetus of seven months, 6.05; of eight months, 7.06; new-born female, 7.32; female of three years, 12.20; male of three year

11.91; and female of fifteen years, 12.29. The figures of Chaussier differ somewhat: the proportion of cerebellum to the large hemispheres being from 1:13 to 1:30, or from 3.28 to 7.7 per cent. The same proportions, with all the astonishing differences, have been found by Gall.

The forehead of the newlyborn infant is narrow and low; the anterior lobes of the large hemispheres must consequently be expected to be proportionately small. Weighing and measuring confirm this conclusion. The anterior lobes in a prematurely born female, yielded only 16.5 per cent. of the weight of the entire large hemispheres; in the new-born, at full term, 22.09; in some who were from eight to twelve weeks old, also but from 16.7 to 18.9 per cent. This figure increases to 22.4 in the first twelvemonth. Whenever a similar figure, for instance 21.8 at seventy-seven years, occurs at advanced ages, circumstances must be peculiarly unfavorable. The remaining, especially the parietal portion of the large hemispheres, must necessarily show the reverse proportion. You remember the figures I gave for the frontal and parietal vertebrae. Now, the anterior lobes of the large hemispheres, in the newly-born, weigh from 60 to 70 grammes; in the adult 300—that is five times as much as in the former; the remaining parietal and inter-parietal portion, however, in the newly-born 250, in the adult 1000 grammes, that is four times as much as in the former.

Now, the principal results of these carefully collected and compared figures are, among others, these: The anterior lobes of the large hemispheres are small in proportion to the bulk of the brain. The cerebellum also is small in proportion to the cerebrum. Both the anterior lobes of the large hemispheres and the cerebellum grow more rapidly in early infancy than the generally rapid development of the infantile brain would explain. That the brain itself grows most, at the same period, in proportion to the other organs of the body, I have often had the opportunity of telling you. Finally, there is little cortical, grey cerebral substance, and not the distinct difference between the grey and white substances of later life.

Just draw your physiological conclusions from these facts, translate as it were anatomy into physiology. The simplest physiological facts you would conclude from the

dates I have given are these. The mental, intellectual faculties of the infantile brain, are little developed ; the less the earlier the period of our observation. The power over the voluntary muscles is very limited, indeed. The mutual counterbalancing of the really central, and the conducting portions of the brain is not well pronounced. There is, with the intense growth, intense action of the brain, in its course of development. The less settled the condition of an organ, the more it is exposed to irregular action. Therefore the great irritability of the brain in general is well explained by its anatomy ; but particularly the intense irritability of the anterior lobes of the large hemispheres and the cerebellum.

This irritability shows itself less by increased physiological action, than by its irregularity and abnormality. For instance, the irritation of the sensory organs, the functions of which are transferred to the grey substance, does not increase their exactness and accuracy ; that is, such patients do not see, hear, and feel better, but they are molested by impressions which were hitherto normal and agreeable. There is intolerance to noise, scintillation, pain in the eye, and on the periphery of the cutaneous nerves.

The increased growth of the cerebral substance explains the great afflux of arterial blood with its normal amount of oxygen. This is particularly the case in those portions of the brain mentioned by me as the seats of intellectual and voluntary motory power. This physiological injection, however necessary for the normal development of the parts, becomes by its very intensity, easily pathological, that is the transition from the healthy condition of the organ to disease is very easy indeed. You know that I have often pointed out to you the necessity of not looking on disease in general as something essential and peculiar in itself, but as the expression of the physiological functions and appearance, under altered circumstances.

In the majority of cases of pathological cerebral hyperemia, brain, cerebral membranes and integuments, are equally affected. Sometimes, however, the injection is noticed only in the larger, and also the smaller, bloodvessels of the membranes ; very rarely the brain alone, and exclusively, is found to be the seat of the anomaly. In other cases the process is but a partial one in other respects ; there are

some in which only the white substance, or the cerebral portion of the brain, or a single hemisphere, or the cerebellum, or even the cortical substance alone are affected. Some of these facts may get nearer their explanation by their anatomical condition; perhaps the falx cerebri, and the tentorium separating principal parts of the brain, prevent the uniform spreading of originally local hyperæmia. Discolorations of the arachnoid membrane, oedematous effusions of the pia mater, and small extravasations are frequent; oedematous mollification of the cerebral tissue, however, are rare companions of the above alteration.

There is no age in which cerebral hyperæmia is so frequent as early infancy, and therefore, also, the period of the first dentition. The newly-born and the healthy male nursling are particularly subject to the primary and idiopathic form, which often depends not only on the physiological afflux of a large amount of blood, but frequently also on the injurious effects of too high a temperature, tea and coffee, opium, and alcohol. The secondary, consecutive form depends on disturbed circulation of the blood, in diseases of the lungs and heart, in overloaded stomach and intestines, inflamed peritoneum; in the somewhat advanced period of infantile life, acute exanthems, typhoid and other fevers, impaired condition of the blood, mental emotions, are not at all rare causes of cerebral hyperæmia. Concussion of the head, extensive and thorough refrigeration of the skin, are further occasional sources of the same affection, and attacks of convulsions produced by whatever cause, become dangerous by the secondary injection brought on by the spasmodic action of the muscles of the neck, and chest, and diaphragm, and abdomen, in a great many cases.

Among the symptoms of cerebral hyperæmia in children those of the motory organs are prevailing over those of the sensory ones. They are often mistaken for those of meningitis, and sometimes so easily that a correct differential diagnosis of the two is by no means possible, except on careful observation of the course of the disease. Generally, such children have suffered from costiveness, for several days, their sleep was restless, they ground their teeth, had frightening dreams, headaches perceptible by the perpendicular wrinkling of the corrugator muscles of the eye-brows,

and took a long time before falling asleep. Vomiting will then set in, the pupil becomes contracted from the irritation of the oculo-motor nerve, and some muscles will be observed to suffer from spasmoid affections. These local twitchings are followed by general convulsions, or the case may be severe enough to exclude the gradual development of these symptoms. In such cases the convulsions, commencing in one limb, or in one side of the face, spread rapidly over the whole body. These general clonic convulsions sometimes alternate with tonic ones, general tetanus taking place; then again the muscles of the neck will be found rigid, in tonic contraction, while the clonic convulsions spread over all the muscles of the extremities. Sometimes a remission will take place after half an hour, or an hour, and the attack may stop altogether; but very frequently the former vehemence of the affection returns, and may even result in death. During the attacks there is no mental nor sensory reaction. The most powerful irritations of the skin are not felt, the pupils do not react, consciousness is entirely gone. The skin is in perpetual perspiration, respiration is interfered with, saliva becomes foamy from the constant motions of the masticatory muscles, and the abdomen tympanitic. Nevertheless in almost every case the prognosis is favorable; always provided that meningitis, both the genuine and the tubercular forms, can be excluded. At the period of life of which I principally speak, both these forms are not very frequent. Genuine, often so-called suppurative meningitis, is generally found after traumatic injuries of the head, or diseases of the cranium. Tubercular meningitis is rarely found before the end of the first, or even second, year of life, and generally preceded by a number of long continued symptoms, of which I need not speak at this occasion.

The symptoms of gradually developed anæmia of the brain are very similar to those attending hyperæmia, as irritation sets in first, followed by depression and paralysis. These symptoms cannot be well explained by a change in compression of the cerebral substance, which may be assumed to exist in hyperæmia, but it appears that a certain amount of pressure, resistance, or tension is necessary, and that both too little and too much are equally injurious. Moreover, physiological experiments have proved that there is always a stage of irritation preceding the entire extinc-

tion of nervous action; therefore, increased irritation is not the result of increased, but of diminished nutrition. Therefore, also, a moderate degree of cerebral anaemia is attended with the symptoms of irritation, the highest degrees, however, with those of paralysis. Thus Marshall Hall distinguishes an irritable and a torpid stage of hydrncephaloid disease. The first name is given to such cases of cerebral anaemia in children, in whom there is still irritation of the motory functions; the second is applied to those already paralysed. In the former, the children are restless, grind their teeth, show frequent symptoms of sudden fright, and shrill out in their sleep, and have a flushed face, frequent pulse, and increased temperature. At last, sometimes, convulsions will be observed. The second stage, which will always follow a mistake made in either diagnosis or treatment, exhibits collapse and apathy in the patients; the power of accommodation is disturbed, the eyelids are half-closed, and the pupils show no reaction to the influence of light, respiration becomes irregular, and under pulmonary oedema and coma life becomes extinct.

I have deemed it proper to compare these two conditions, anaemia and hyperaemia, for their practical importance. Both are as frequent as they can become dangerous. You see, however, at once, from the various, both physiological and extraneous causes capable of producing hyperaemia of the brain, how little space is left for the assumption of dentition, that is the protrusion of a tooth, being in itself a cause of cerebral hyperaemia. The fact is, as I have often said, that hyperaemia of the brain, and such either local or general symptoms as are generally attributed to dentition, are co-ordinate results of the physiological process of local irritation and development, be they normal or excessive; with the exception of those few cases, where a local inflammatory process in the jaws or gums will give rise to fevers and their sequels.

The equality of a portion of the symptoms in a large number of cerebral diseases is a well known fact. The prevalent liability to one of them, viz. convulsions, is a peculiarity of infantile age. The smallness of the large hemispheres explains the suddenness of the loss of consciousness in very young children; the undeveloped condition of the cerebellum explains the loss of power over every

one of the voluntary muscular actions. Thus convulsions are very frequent occurrences in very early infancy, and it can be said, that the number of cases decreases with every month. This is positively true, and the often repeated statement of the greater frequency of convulsions during dentition, that is, during and after the second half-year, is a mistake. My own experience, moreover, has not been able to convince me of an assertion I have often heard from good observers, viz. that the period of the second dentition should be more fertile in attacks of convulsions than that immediately preceding. Let us see, however, on which facts this assertion is based, and whether or not dentition, either first or second, is so very influential in producing convulsions, that the diminution of attacks with increasing age should be essentially interfered with. It will be our main object to investigate the principal causes of convulsions in infantile age, the place among these causes which can reasonably be assigned to dentition, and thirdly, the manner in which the protrusion of a tooth can become the cause of an attack of convulsions.

I have spoken of cerebral and meningeal hyperæmia and anæmia as causes of convulsions. Almost every one of the morbid conditions of the brain, and many of the skull, have the same results; for instance, inflammation and its consequences, mollification, pseudoplasms, particularly of tubercular nature, exostoses of the cranium, etc. These are very frequent causes of convulsions, and allow of but an unfavorable prognosis. Their majority is not of a primary nature, but the secondary result of diseases in distant organs, as those of digestion; or of dyscrasias, or some functional anomalies; they are very generally followed by effusion, or complicated with cerebral hyperæmia of more or less serous character. Such convulsions afford the aspect of a real cerebral affection, the attacks being either clonic or tonic, and always combined with loss of consciousness. Sometimes they show a singular periodicity; epilepsy is often traced to early infancy. Only in such cases where the spine is gradually participating in the affection of the cerebral substance or its meninges, the convulsions assume a peculiar tetanic character. As a general rule, they are universal; the muscles of the face, thorax, and abdomen, and the extremities, appearing to

be principally affected, either contemporaneously or alternatively. Sometimes, however, they are singularly local. Both in children and in adults, the *m. rectus internus* is frequently convulsed by an affection of the *n. abducens*; the oculomotor nerve, the motor portion of the fifth, facial, and hypoglossus nerves are frequently the only parts affected; and the local convolution of the *gastrocnemius* muscle, depending on a few ramifications of a spinal nerve, is no rare occurrence.

Next to those mentioned hitherto follow the convulsions depending on some change taking place in the blood. Poisons introduced into the system, like opium, *nux vomica*, and strychnia, lead, mercury, and ergot, produce convulsions belonging to this class. Obstructions in the venous circulation of the brain or the large vessels of the neck have similar effects, while obstruction in the arterial circulation is attended with quite different symptoms. For ligating the carotid arteries, or emboli in one or more arteries of the brain, are very apt to give rise to sudden paralysis. To this class there also belong changes taking place in the milk of the mother or wet-nurse, in consequence of alcoholic beverages or mental emotions. Further, the effect of malaria and the unknown principles active in the eruptive stages of exanthematic fevers; the decomposition of the blood in phlebitis and pyæmia, uremia, and cholæmia.

Of a somewhat different nature are those convulsions which depend on anomalous functions of, or contents in, the stomach or intestinal canal. Improper food and therefore defective digestion, fermentation, flatulency and colic, and intestinal worms, are almost as frequent in the wealthy as in the poor; therefore convulsions from these causes are often observed, but fortunately the majority of them is not very dangerous. Spontaneous vomiting, or evacuation of the bowels, will very often have set in before the doctor has time to call, and the child appearing to struggle a short while before, as if dying, is lively and busily engaged with his toys. Not quite so frequent as the former are such convulsions as depend on diseases of the respiratory organs. Sometimes a severe attack of bronchitis or pneumonia will set in with convulsions, but generally the last stage in fatal cases will be the most usual time for their

appearance; then they are but the symptoms of imminent death. General convulsions during the spasmoid attacks of hooping-cough are not very frequent; they are observed as the results of the spasmoid contraction of the abdominal muscles, diaphragm, and the expiratory muscles generally, which repel the blood into the large veins and produce cerebral congestion, by not allowing the blood to leave the cranium by means of the jugular veins. They are dangerous from two causes; first, from the congested condition of the cranial cavity, and finally from the more or less protracted period necessary to subdue a severe hooping-cough. This danger is a real one, in spite of the improved means of really both shortening the duration, and mitigating the attacks of this disease.

The urinary and sexual organs also influence the nervous system sufficiently to give rise to convulsions. The allusion to uremic poisoning of the blood, of which I have spoken just now, will suffice to direct your attention to diseases of the kidneys and albuminuria. Testicles retained in the inguinal rings have been known to produce convulsions. Diseases of the bones also have a similar effect, if we are to follow the opinion of such authors as consider rhachitis, and the rhachitical condition of the cranial bones, as a disease of the osseous system. I must say that I do not participate in this opinion; the rhachitical process shows best in the bones, but they are neither the only, nor even always the most important part amongst those affected. And as to craniotabes I do not hesitate to say, that the convulsions occurring during its course are the result of meningeal and cerebral effusions which are very apt to take place contemporaneously. Hypertrophy, however, of the cranial bones, and premature ossification of the cranial fontanelles and sutures, will sometimes give rise to convulsions.

Finally, I should mention the occurrence of convulsions resulting from influences on the external skin and sensory organs. Refrigeration, by both congestion to the internal parts and irritation of the peripheric nerves, is known to have this effect, sometimes; so is brilliant and sudden light striking the eyes, or unexpected and extraordinary sound hurting the ear.

After all, the origins and seats of convulsions show a great many varieties. While a number of cases depend on

the nervous centres, particularly the brain, others depend on some irritation influencing either the course of the nerves or their peripheric ends. Of the highest importance, however, are such as depend on the irritation of sensitive nerves, which at the origin of both the sensitive and motory nerves is communicated to the latter, by them reflected to their peripheric ends, and there active in the muscular contraction. To this class of reflected spasms, reflex-convulsions, belong those of which we have spoken as produced by irritation of the urinary and sexual organs, of the skin, and also of the respiratory and digestive organs. To this class also belong those cases, which undeniably may be observed sometimes as the result of irritation of the last ramifications of the dental nerves. This will happen in such cases, in which the protrusion of a tooth is really attended with, and even prevented by, an inflammatory disease of either the jaw or gum.

LECTURE XII.

General Classification of Convulsions.—Dental Paralysis.—Name and Synonyms.—Views of Dr. von Heine.—Symptoms and Consequences.—Etiology.—Dr. von Heine's Reasons for its being a Spinal Affection.—Why it is not always a Spinal Disease.—What it is.—Laryngismus Stridulus and its Relation to Dentition.

THE remarks made in my last lecture on the various causes of convulsions, and the influence of some irritation of the dental nerves in bringing them on, enable us to classify their etiology in the following manner. Convulsions result from

- I. Direct irritation either
 1. in the peripheric course of motory nerves, or
 2. in their origin in the central organ.
- II. Irritation of sensitive nerves, the grey substance of the nervous centres being the joining link between the sensitive and the motory nerves,
 1. consciousness being entirely excluded—reflex-convulsions proper.
 2. consciousness being more or less excluded; the brain is the proximate seat.
- III. Anomalous nutrition of the nervous tissue
 1. in the peripheric nerves,
 2. in the brain,
 3. in the spine.

In this latter class the morbid symptoms are either permanent, or temporarily induced by either

1. direct irritation, or
2. irritation of and through the sensitive nerves, or
3. voluntary action.

In this classification we cannot include the sometimes permanent contraction of the muscles which does not at all depend on any morbid condition, or irritation, of the nervous system or a single nerve; nor those which, it is true,

are brought on by either direct or reflected irritation, or by voluntary action, but at all events require a morbid condition of the muscular substance.

Although the above classification is thoroughly physiological and rational, you perceive at once the difficulty of bringing every case of convulsions occurring in practice, under its proper head. It is entirely impossible to know enough of the history of the patient and of the immediately preceding irritations in every given case, to determine its character. But this much is easily understood, from what I have said, that the large majority of cases of convulsions are of but a symptomatic character, and further, that the proximate causes may be very various and numerous. Therefore it follows, that the practice of explaining attacks of convulsions occurring during dentition, that is, a period of life where a large number of unwonted influences are brought to bear upon the unresisting infantile organism, by nothing but the irritation of the dental ramifications of the fifth pair of cerebral nerves—is entirely one-sided and unjustified. It is true, however, that the distinction between the various possible causes requires more pathological knowledge and diagnostic ability than mere dictatorial airs and the common practice of wantonly cutting down into the gums of a child affected with some unexplained ailment. Always be aware that convulsions are no disease, but the symptom of some morbid alteration or irritation, and that these alterations and irritations are very numerous and various, and that of those very numerous and various irritations, the protrusion of a tooth under more or less unfavorable circumstances, may be one.

Now, after you have reviewed the principal points of the etiology of convulsions, and found out with me the possible connexion of dentition and convulsions, I have yet to speak of the connexion of the same process with paralysis, as occurring in young children. Most, but by far not all, of the cases of paralysis in infantile age are observed at the period of dentition, that is, about or after the middle of the first year. Inasmuch as the age in which this affection was principally observed, struck the minds of observers most, it was called *infantile* paralysis; because its etiology and nature were not understood, it was baptized *essential*, as we are pleased to name everything the nature of which we do

The whole number of paralytic cases recorded by Dr. Heine amounts to 192. Of these, 158 were such as he comprehends under the head of spinal infantile paralysis. Of these were—

| | Males. | Females. | Total. |
|-------------------|--------|----------|--------|
| Paraplegia | 17 | 20 | 37 |
| Hemiplegia | 18 | 16 | 34 |
| Partial paralysis | 44 | 40 | 84 |

Paralysis of one arm was observed in two cases; it was never cured, and was never complicated with paralysis of any other organ. Paralytic lordosis was observed in a single case.

The second stage, that is, fully developed paralysis, is as long as the former is short. Vital turgor is diminished, skin and muscles are flabby. The sensitive nerves are not at all or but little affected; where there is in the beginning paralysis of the trunk and arm it disappears, with the exception of a weakness of the muscles of the back sufficient to give rise to paralytic scoliosis. Where the two lower extremities are affected, one will gradually recover its mobility, and sometimes nothing will remain of the original disease but the paralysis of some muscles, principally the peronæi. There is, however, seldom a thorough improvement after the first four, or eight weeks: then the temperature sinks, feet and muscles become atrophic, the bones decrease in both length and thickness. The muscles will shorten, the tendo Achillis being the first to contract; in consequence of repeated attempts at locomotion, deformities will at last show themselves. Lateral curvatures of the vertebral column are very frequent: a bluish tint of the skin, frostbites, and ulcerations are the results of the diminished efforts of the heart and arteries. Bowels operate slowly and insufficiently in many cases; menstruation is not interfered with, and in a single case was even observed at the early age of twelve years. Neither mind nor senses are affected. The renal secretion is more or less normal; some have found a superabundance of phosphate of lime at the time of the commencing atrophy of the muscles, but not all the authors have obtained the same result. The diseases peculiar to early age do not prove particularly dangerous, so that some patients have been known to reach an advanced age. Hutin records the case of a man who died at forty-nine years.



healthy, robust, and vigorous constitution of those generally affected, also to the presence of general symptoms of fever (also in other diseases), high temperature, congestion, convulsions, fright, screaming, and vertebral pain in such children as are sufficiently advanced to explain their sensations. Thus the author sees the cause of infantile paralysis in spinal effusions, in some perhaps in extravasations. The former supposition he considers as founded on the fact, that (by resorption, he says) a complete paralysis of the trunk and extremities will very generally disappear, to a certain extent, during the first period of the whole process. As to the results obtained by post-mortem examinations, they are very few indeed; for as infantile paralysis has in itself no tendency to terminate fatally, there are very few examinations on record. At all events, however, there are a few, which by their pathological results proved the spinal origin of the cases. As for other results found in the dead, they give no clue to the anatomical cause of the affection. Such, for instance, is the atrophy of the limbs, especially the muscles, and the degeneration of the latter into adipose, and in one instance even cellular tissue. Nerves and arteries require, it is true, a longer time, and have less tendency to become atrophied and degenerate, but they have been found to be so.

According to Dr. Heine, we need not wonder at the frequency of spinal diseases of local character. It is sufficiently explained by its normal hyperæmia, and its functional character. Lesions of the entire spine, however, are very rare; but Prof. Schiff has proved by experiments, that the affection of a limited part of the medullary substance of the spine may result in complete paralysis. Generally a lesion of the right side will be followed by paralysis on the right side, and *vice versa*. The action of the sensitive nerves may remain normal, a circular pain only being felt in cases of mere compression of the spine, depending on dilatation of the blood-vessels, and effusion, or certain other diseases of the membranes. This circular pain may even be absent when the anterior lateral parts of the spine are affected. In cases of very superficial and partial affections of the spine, paralysis will be partial in a corresponding degree.

The reasons why Dr. Heine feels justified in considering infantile paralysis as spinal, are derived from the real or

supposed peculiarities of such cases in their last stage. They are, in his own words, the following :

1. The cerebral functions of the patients are entirely intact. No case of his exhibited any disturbance in either mental or sensory actions. Wherever there were any cerebral symptoms in the beginning, they disappeared rapidly.

2. Paralysis followed immediately the symptoms of a general and central disease, as fever, convulsions, congestion. Paralysis from peripheric causes shows frequently the reverse, as there is an interval between the first attack and the last stage, *viz.* that of paralysis.

In the commencement of essential paralysis, contraction is never observed ; the limbs are perfectly paralytic, and paralysis takes place in all the affected parts at the very same time : it has, in the first period, a tendency to gradual decrease, but never to progress. Both arms are not affected at the same time, nor are arm and leg of the same side ; but always either both legs, or one arm, or one leg. Affection of the trunk is not unfrequent ; it produces paralytic scoliosis : in such cases the motory nerves of the lumbar and sacral plexuses of the corresponding side, together with other spinal nerves, are suffering. Where but a single arm is paralysed (a rare case indeed) the affection has its seat in the brachial plexus of the corresponding side ; in most of these cases all the muscles are affected. Cases of transverse paralysis are very rare occurrences. The sensory organs are hardly affected, except in the very commencement, and then, too, but slightly. There is no pain in the secondary period.

3. Frequently it is met with in, and limited to, the two lower extremities. Hemiplegia, paralysis of but one side or extremity, is frequently the last remainder of paraplegia.

4. It is very intense. In many cases the muscles of the trunk are also paralysed ; this affection may generally diminish, but the spinal character of the paralysis will be shown by the characteristic scoliotic curvature, and sometimes by the enormous deformity of the whole trunk, which differ considerably from other cases of scoliosis, and exhibit a decidedly paralytic character.

5. In this paralysis, the atrophy of the affected limb is considerable, its temperature decreases fast and very much

indeed. These symptoms are not so decided in motory paralysis depending on diseases of the brain ; and moreover, Prof. Budge has proved by direct physiological experiments made on the spine of rabbits, which he cut for this purpose, the influence of the spine on the temperature of the body. The decrease of temperature is more pronounced in the periphery than near the centre ; it has been observed to be as low as sixty-three and a half degrees. Motory power, nervous influence, and circulation are considerably diminished, and therefore the lower temperature is readily explained. Arteries and veins have been found smaller than normal ; to such a degree, even, this diminution of size and lumen may proceed, that Hutin has a case in which a number of smaller bloodvessels had entirely disappeared. The diagnosis from wasting palsy (*atrophie musculaire progressive*, Cruveilhier) is established by the fact, that in wasting palsy the atrophy is the primary suffering of which paralysis is the natural consequence ; whereas, in essential paralysis the atrophy is secondary, and brought on by the diminution of both nervous influence and circulation of the blood.

6. In paralysis of an arm, which sometimes would set in with the same symptoms as those described above, the post-mortem examination has proved a material alteration of that portion of the spine from which the brachial plexus takes its origin.

7. There is a total want of galvanic reaction and electrical contractility in the paralysed muscles, in infantile paralysis. The experiments of Duchenne and others yield a negative result in spinal paralysis, while in cerebral paralysis the sensibility is always intact, and sometimes even increased to painfulness. Nor does peripheric paralysis participate in this peculiarity of the spinal form. These differences have often been used for obtaining a correct diagnosis of the local cause of the disease.

8. All the authors agree in the assumption of the spine being affected in most paraplegias, in which standing erect, and walking, are rendered impossible. While then paraplegia must be supposed to depend on a general and thorough bilateral affection of the spine or its membranes ; our cases of essential paralysis give rise to the assumption of an either local, or universal alteration.

9. Essential paralysis is incurable ; peripheric paralysis is not so.

10. Finally, the aspect of such patients, and the drawings taken from them, give the impression of a deep-seated disease of the nervous centres, perhaps even the spine.

Such are, in the opinion of our author, the leading pathognomonic qualities of dental, essential, or "spinal infantile" paralysis. I am, however, so far from assuming them to be indisputably correct, that I think it necessary to answer several questions, of which one is this : whether essential paralysis is really a disease of the dental period, and another, whether indeed it is always the result of a disease of the spine.

We have been taught, and experience proves, that the first onset of the disease resulting in essential paralysis, may show great differences both in its symptoms, and in its course. Sometimes the final result is produced unexpectedly fast ; sometimes, however, the predisposing cause requires some time to bring on the necessary alterations. For certainly, we require of necessity, permanent local alterations to explain permanent paralysis. The principal symptoms of the first attack which I have mentioned before, belong either to the brain, or the spine, or the nerves, and, from this fact, contrary to the assertions of the author, we should feel obliged to conclude that the subsequent paralysis would be either of a cerebral, or spinal, or peripheric character. For the simplest facts of the pathology of the nervous system show, that like convulsions, paralysis may have its primary seat either in one of the nervous centres, or in the course, or in the periphery of a nerve. If paralysis with the same symptoms as the dental or essential form, participates in the general characters of paralysis, if further the symptoms of the first attack are either cerebral, or spinal, or peripheric, are we justified in assuming the spine to be the only seat and cause of the consecutive paralysis ? At all events, the dictatorial words of the author, that "cerebral symptoms may be present in the beginning, but are not connected with the paralysis, and *must not* be brought into any etiological relation to essential paralysis," appear too little based on the generally known facts of physiology. It is not true, indeed, that in cases where paralysis is ushered in with symptoms of cerebral irritation, while

these symptoms disappear afterwards and leave the mental faculties intact for the future, the brain is not affected. Those cases of paralysis in which this very paralysis was the prominent, or rather only symptom during life, and the post-mortem examination revealed some of the traces of recent or old apoplexy in the cerebral substance, as for instance, encysted remnants on the dura mater, in both adults and children, ought to be satisfactory proofs to the contrary. At all events, I am a little slow in believing in the actual correctness of the remark of our author, that the premonitory cerebral symptoms are usually slight, but that in very violent attacks life may be endangered, although fatal termination without complications has not been observed *by him*. I have no doubt that this last addition is correct. For institutions like his, receive their patients after the disease has been allowed to remain a shorter or longer period, when the narratives of the relations are the only guides of the specialist; and indeed, such patients as are brought into an institution for the performance of tenotomy, and the application of extending apparatuses, etc., do not belong to the number of those who died in the first attack. If the doctor meant to say that, it was a superfluous undertaking.

You have heard that but few post-mortem examinations of old cases of essential paralysis are on record. In some, local alterations inside the vertebral column have been found, in others not. Dr. von Heine takes those in which the results of extravasations or exudations were visible, as spinal. Good. Those in which nothing has been found, however, he also considers as spinal, because either microscopical examinations (which have not been made or have given no result) *might* have afforded a proof, or because there are cases in which paralysis is not explained by any pathological changes. The latter he takes as spinal; thus for instance a case of Longet's in which the examination resulted in finding no spinal disease, but atrophy of the roots of some nerves. Nor is he less bashful in explaining away pathological results. Thus a case of Behrend's in which both brain and spine are described as diseased, is also crowded into the spinal flock of paralyses.

You see after all, that not in every case of dental or essential paralysis a diagnosis can be made, inasmuch

as the differential diagnosis of the first insults could not be, or was only made during, or from the former periods of the disease. But always be sure to bring into account not only the spine, but be aware that diseases of all the nervous centres and motory nerves may be the causes of paralysis; on the only condition that they give rise to alterations essentially injuring the action of the nerves. It is true, further, that many diseases are more frequent in a certain age; and that the symptoms, in spite of the same locality and character, may differ according to age and individuality; but this certainly ought not to influence and prejudice us so far as to multiply our classifications and varieties. For prejudice when once allowed to prevail in pathology, will lead to further extravagances. Thus Dr. von Heine means to simply exclude the cases commencing with cerebral symptoms, terminating in paralysis, and finally recovery, from the number of the dental, or spinal infantile paralysis—because of their recovery; while incurability is taken by the author as one of the prominent proofs of the essential "spinal infantile" paralysis. Who ever made his diagnoses from the results of treatment? and who ever, except our celebrated author, would at the same time deny the existence of rheumatic paralysis, and yet consider those favorable cases as rheumatic? If further, spinal infantile paralysis depending on extravasation or exudation inside the vertebral canal is as incurable as he makes out, why is it that he still recommends the internal administration of absorbents? Have his 150 cases proved the incurability so thoroughly, or have they informed him, as many of my own have me, of the possibility of removing exudations or extravasations from the vertebral canal with the similar ease, or rather difficulty, as in other not very accessible localities?

Several other remarks and assertions of the author's are not more justified by facts. Thus it is not true, that the paralysis in the dental, or essential form, is more complete than in other kinds. The condition of the joint of the humerus, with its easy luxation and reposition, and the peculiar flabbiness of the muscles of the arm, are not at all characteristics of this disease. It is even observed in paralytic adults, with this exception, that both muscles and liga-

ments are more flaccid and stretch more easily in children than in adults. Nor is the absence of primary contraction in essential paralysis based on facts; the author himself does not believe in his own assertion as he mentions the paralytic form of scoliosis as depending on the asymmetrical contraction of the dorsal muscles. The real facts of the case are these, that the kind of paralysis of which I have spoken is seldom complete, but differs in the manner in which single muscles are affected. The equal power of antagonists is suspended; thus contraction is brought on by attempts at locomotion, and exercise in general as mentioned above. But this is not the only cause of contraction. For it is well known, especially in cerebral diseases, that the presence of a certain amount of extravasation, or effusion, gives rise to the symptoms of irritation, while a slight increase in the amount leads to depression and paralysis. We have no reason to believe this to be different in the spine. This early contraction depends on the presence of irritation, on the proportionate mildness or severity of the case, whether cerebral or spinal or peripheral, but not on the seat of the affection.

Nor is the seat of the affection so infallibly announced by the galvanic irritability of the muscles. For there are now a number of cases on record in which its absence in spinal diseases, and its intact condition in cerebral affections, were by no means constant and incontestable. Nor is the decrease of temperature greater in essential paralysis than in other forms; not the seat of the disease, but the duration, the age at its first appearance, the atrophy, the nature and number of the affected (motory, sensitive, or vasomotory) nerves, and all the other causes of animal heat must be taken in regard, and may act just as thoroughly in cerebral as in spinal paralysis. And the atrophy itself, which has been said to show itself more rapidly in essential paralysis, depends not on the form or seat of the disease, but again on some of the above-mentioned factors; on the rapidity of changes taking place in the infantile organism, in which infantile paralysis is mostly observed, and on the prevalence of fat at this age, which disappears more rapidly than any other tissue.

Finally, the assertion of Dr. von Heine, that the majority of cases of essential paralysis do not only occur in healthy

the spinal column, especially in very health and the amount of blood circulating in their organism predisposes them to degeneration and atrophy in the vertebral canal, is, to my mind, somewhat hypothetical. The amount of blood circulating in the spinal cord is proportionate for a short time at least to an increase, increase in proportion to time of existence. If this is true in the adult, it is the case as I believe. On the other hand, it is a general observation that compression and effusion will shorten the lives of young individuals. It is true that spinal disease is often a result of dynamic processes, such as bone destruction by the occurrence of essential hypertension, or by the use of other mechanical reasons, and the result is by degeneration, I believe to become such as to cause an organic obstruction.

There is, I believe, a direct diagnosis in many cases of spinal disease, which is called. If any other part of the human body is more liable to the variety of diseases respecting the spinal. Dr. E. Miller considers, that although he never has seen it very often, the symptoms show it to first-mention time that the seat of the disease lies in spinal canal, in the spinal process of the nervous system. Whether this is a symptom of excitation, whether they are due to effusion, this after according to the cases. Dr. Miller says in answer to Dr. von Heim says that extravasation of the cerebro-spinal fluid is a symptom of sudden and obscure origin, and it seems to Dr. Miller that every case of sudden and obscure paraparesis results from spinal extravasation. V. V. V. is a case of extruding the disease to a spinal affection, because in the nervous functions of the subject are not destroyed, but are due greatly to the pressure and irritation of spinal canal and more than any other disease. Dr. Miller says in the case of essential hypertension it is because it is not the cause in general, if the spinal and intervertebral canal become full of arterial vessels and slight compression, venous pressure would bring in blood in the spinal, if this were inverted position of the spine. The cause is in the ventricle of a lumbar or sacral canal, and the cause of the disease will last compression of spinal canal which can be produced by the spinal compression or inflammation will their final result, which. Zeller and Bierley, New Bedford, Mass.

Hall, Kennedy, take it as a peripheric disease; dental irritation, remittent fever, convulsions, worms, intestinal affections, influence of cold temperature, sitting on a cold stone, etc., etc., are accused as being the causes. Shaw supposes the disease to depend on a sudden change taking place in the brain or spine. Brown-Sequard, finally, takes infantile paralysis as a reflex-paralysis, the existence of which he, like his assistant, Dr. Echeverria, now in this city, tries to prove with all his immense learning in both physiology and pathology. Naturally, dentition and worms have their part to play among the proximate causes.

I have merely to add, that as I have above given my opinions based, I believe, on the symptoms and the facts of pathological anatomy, I am not willing to give up an explanation of this kind for any other, although it be more brilliant and more surprising. Nor am I ashamed to say that there is no uniform anatomical alteration in all and every one of the cases of infantile, or essential, or dental paralysis. The symptoms are such that they can be explained by a certain number of pathological conditions, and it is not my fault that, in nature, the same ends will be frequently obtained by multifarious causes. If really dentition had anything to do with this paralysis, it could be so in but few cases, and be only explainable by the assumption of reflex-paralysis; for a subsequent hyperaemia of the brain or spine would again justify my more anatomical explanation. How absurd, however, is it to baptize it dental, for no other reason but that a few cases may possibly be induced by some anomalies in the protrusion of a tooth. In every case, moreover, of any disease, we ought first to inform ourselves of its nature, its anatomical basis, and its seat, and then at last to look for the occasion on which it commenced, and the more distant causes by which it has been brought on. If no cause could be found in any case, the name "essential paralysis" would be the better one in my opinion; but as in the majority of cases a differential diagnosis can be made with either certainty or probability, it is merely scientific to determine its character in the diagnosis, and the name applied to the disease.

Another disease, which is almost always considered as being in a causal relation to dentition, is laryngismus stridulus, or crowing inspiration of children.

Laryngismus is emphatically a disease of infantile age. It is observed as well in apparently healthy as in sick children; in their sleep or while they are awake, playing, eating, singing, or to the contrary, when irritated, or excited. The first stage of an attack of laryngismus is a sudden and entire apnea. Respiration is stopped suddenly, completely, for a few seconds, even for a minute, the face is bloodless and pale, and cyanotic in attacks of long duration, the skin cool, the heart scarcely perceptible, the entire muscular system in a state of paralysis. The second stage is that of beginning reaction to this complete inactivity; the recurrent branch of the pneumogastric nerve commences again to stimulate the function of the muscles of the glottis, and the spinal nerves again enliven the other respiratory muscles to such an extent as to produce a forced, deep, "crowing" inspiration. In the third stage, finally, reaction is complete. Short convulsive expirations restore the functions of the respiratory organs to their former condition. Attacks of great intensity and long duration are generally attended with contractions of the hands, and even general tonic convulsions of the trunk (opisthotonus) and lower extremities. Sometimes general eclampsia has been observed to accompany the attack of laryngismus, but also to return without an attack, or an attack of laryngismus to return without eclampsia. Involuntary evacuations of the bowels have been observed during the attack; these are the consequences of paralysis of the sphincter muscles. Laryngismus is seldom fatal; a large number of attacks have sometimes occurred in a single day. The disease is apt to last for months, and even years. Whenever death ensues in the attack, it does so in the first stage.

The mildness or severity of the attacks of laryngismus depend on both the constitution of the patients and occasional causes. The milder form is particularly recognised by a milder appearance of the first stage, viz. the sudden paralysis of the respiratory muscles, and the slightness of the accompanying carpo-pedal or other symptoms. Of this kind are those mild attacks which have been described by Rilliet and Barthez, Hérard, and Ranking, and called "holding-breath spells" by J. Forsyth Meigs. Here, the first stage is not very violent, and crowing expiration is not always perceived, but in the cases witnessed by myself, I

have never missed the convulsive expirations constituting the third and last stage. Altogether, I am unable to discover any other difference between an attack of "laryngismus," and one of "holding breath spell," but that of a different severity of symptoms of the same affection; for in my mind there is no doubt that the assertion, that the latter "never occurs spontaneously, and never during sleep," and that "the most frequent cause of the paroxysms is contradiction; that they are determined also by fright, pain, and crying," is either not quite correct, or not quite complete.

The symptoms of the first stage of laryngismus cannot be explained except by a functional trouble, by paralysis, perhaps of the oblongated spine, perhaps of all the nervous centres together. Paralysis of the muscles of the glottis alone is unable to produce all the symptoms of the first stage of laryngismus; for by cutting a recurrent nerve such general symptoms could never be produced. And the dissection of both the recurrent nerves gives rise to real suffocation, pretty rapidly, but not at all suddenly; lungs and brain become hyperæmic, and the heart and cutaneous veins full of blood; whereas post-mortem examinations in laryngismus show a positive absence of hyperæmia in the brain, and no, or very little, blood in the heart and cutaneous veins. Death ensues in laryngismus in the same manner as in animals whose oblongated spine has been cut. They die either instantaneously, both respiration and circulation ceasing at once, or some few contractions of the extensors of the trunk and lower extremities are observed before; local hyperæmia is found nowhere, neither in the brain, nor lungs, nor heart.

As to crowing inspiration, it does not properly belong to the attack of laryngismus stridulus; it, as also the convulsive expirations, are symptoms of returning reaction, that is, the recommencing of nervous and muscular functions. It is also met with in catarrh of the larynx, where the muscles of the vocal cords are spasmodically affected, and is, therefore, by no means a pathognomonic symptom of laryngismus.

This affection is mostly observed at the time of the first dentition, about the second half of the first year. I have often spoken of this period as one of general and rapid

development of all the tissues and organs of the infantile body, and therefore I refer you to previous lectures. But I have here to direct your attention to the intrinsic similarity of this period of life with that of puberty, which also excels by its general rapid development. It is but natural that neuroses should be frequent in either, from this very physiological fact; and so they are, indeed. As in all cases of nervous diseases, however, so have all sorts of influences been accused to be the causes of laryngismus: indigestion, cold, fright, morbid predispositions, ascarides, hypertrophy of the thymus gland, and every one of the imaginable affections of the pneumogastric and sympathetic nerves. And certainly dentition, the nightmare of both the public and many medical men. They may almost be excused by you on learning that even such men as Marshall Hall, direct, in laryngismus, the gums to be incised, in different places and directions, once, twice, and even three times a day, and expect a cure from this sort of butchering art, or scientific butchery. I warn you most emphatically against following his advice to the extent in which it is given. In some cases incisions into the gums may be indicated, and I sometimes make them myself; but this readiness to operate on helpless children, who are so unfortunate as to "teethe," that is to say, to be from six to thirty months old, is, to say the least, a mistake. I shall, however, avail myself of an opportunity to give my further views on the habit of "lancing the gums" in a more explicit manner, in my next lecture.

The large number of causes to which laryngismus has been attributed, and the various mistakes that have been made in the determination of its nature and character, have given rise to a number of names for this very same affection. Amongst them are foremost, besides laryngismus stridulus, apnoea of infants, thymic asthma, croup-like inspiration, crowing inspiration, spasm of the glottis, paralysis of the glottis, suffocative asthma, stridulous angina, internal convulsion, and others. The difficulty in finding a correct interpretation of the symptoms, and even accurate names, has been so great, that the disease has become known by the name of "Kopp's asthma." Even this is incorrect; for Kopp, who wrote in 1830, has not been the first to give an exact description of the disease, moreover with an erroneous etiology, as he was preceded by Hamil-

ton in 1818, John Clarke in 1815, and Alexander Hood in 1827.

I have stated that the cause of laryngismus must be looked for in a nervous centre; at all events there is no disease of any of the respiratory organs which exhibits similar symptoms, and post-mortem examinations have resulted in nothing that could explain those symptoms by any local alterations in the lungs or heart. Old Goelis already describes cases of mild laryngismus in connexion with chronic hydrocephalus. Keitel found, besides a hypertrophied and degenerated thymus gland, the skull soft, and its sutures and fontanelles large, both the osseous and cerebral tissues soft and hyperemic, oblongated spine also soft, its membranes congested, and a tablespoonful of clear serum in the upper portion of the vertebral canal. Marshall Hall once found the oblongated spine harder than normal; Evans made the observation of a child born with spine bifida, who would have an attack of laryngismus whenever the liquid of the sac was pressed into the vertebral canal. Caspari found the substance of the spine solid and white, and its dura mater much injected. The sinuses of the brain were filled with an enormous amount of black and thin blood, the substance of both the large hemispheres and cerebellum very soft. The phrenic nerve, moreover, was uncommonly hard, but the pneumogastric nerve "appeared more similar to the brain."

After all, the uniform presence of some alterations in the nervous centres appears to prove my first proposition, that laryngismus is the symptom of a deep-seated anomaly. In many cases congestion and inflammation of the membranes, especially the brain, have been found, together with their consequences, viz. more or less transudation. This process may take place very slowly indeed, and very generally does have a slow progress. Many cases of cerebral or meningeal effusion undoubtedly take place without laryngismus, but that laryngismus should occur without any affection of the nervous centres is more than merely doubtful. But there is one disease which appears to be the fundamental cause and origin of laryngismus. It is rhachitis. I merely refer you to a former lecture in order to remind you of these facts, that rhachitis is not only a disease of the osseous tissue, that originally, indeed, it is

the result of disorders in digestion and assimilation, and that impaired nutrition brings on anomalies in all the system thus intimately connected with rhachitis. Particularly it is the form of rhachitis which is found in nurslings, which is apt to bring on severe and general symptoms, viz. the rhachitical softening of the cranial bones, or craniotabes, of which I have also spoken in a former lecture. Craniotabes is always connected with meningitic processes, effusion between the meninges, or into the brain and its ventricles; and thus its direct connexion with a large amount of cerebral effusion and its consequences is easily understood.

Old authors, whose reports Elsaesser has collected in his book on "the soft occiput," although they did not understand the importance of the rhachitical softening of the parietal and occipital bones, relate a number of post-mortem examinations and cases illustrating the subject. Of the cases of Kopp, one who died at ten months, had a very large fontanel, ununited sutures, and very flexible cranial bones; in another who died before the end of the fifth month, he mentions flexible cranial bones, and large fontanels. Caspari relates the case of a child, which was very large and fat, but always had "phlegm on his chest," and a large head, large fontanels, and swollen epiphyses; he adds, that the majority of his infants affected with laryngismus stridulus, had a rhachitical predisposition. Other writers accurately describe cases of craniotabes, the symptomatology of which I have given you in my lecture on the connexion of diseases of the bones with dentition. Thus Pagenstecher speaks of a child who was very large and fat, and was affected with convulsions in his seventh month, and afterwards with attacks of apnoea. Being sick so long, it grew emaciate and thin, and his skull had quite a peculiar, no longer spherical, but remarkably irregular and asymmetrical form. Hirsch found twice, a large head, and large fontanels. Keitel describes the attacks, and body of a child who died in his twenty-second week, and had mostly ununited sutures; the small, triangular fontanel remained still open; the quadrangular was unproportionately large, and the skull soft and thin. Hachman has a similar case. In Günther's child, after weaning, "a true rhachitical constitution" developed itself, and gradually also the attacks of laryngismus. Landsberg also found the sutures open,

and delays in protrusion of the teeth. In one case of Hauff's, all the cranial bones appeared of a dark blue color, and were so little ossified as to be easily cut by means of a knife and scissors, and so thin that the squamous parts of the temporal bones, and some parts of the parietal and occipital bones, had the thickness of good-sized paper. In another, the chest was very similar to the "chicken chest," and the commencement of rhachitis could not be denied. A child of Staub's had already in its first year the unmistakable symptoms of rhachitis, and had its first tooth at eighteen months.

Many such cases could be collected from literature; but those above taken from older authors, suffice to illustrate the connexion between craniotabes and laryngismus. It is true, however, that not every case of this affection must necessarily be the result of craniotabes. Elsaesser reports the case of a child who had laryngismus brought on by hooping-cough, not before his craniotabes had healed; and there are a few cases of laryngismus in the second or third years, where craniotabes is generally no longer present. Thus other causes may bring it on; but do not forget, that nervous affections will oftentimes not disappear with the removal of their causes, and that together with craniotabes, alterations take place inside the cranium which are not so liable to heal as the affection of the osseous tissue itself; therefore, craniotabes may still be the cause of laryngismus, even where it appears to have entirely passed by. I hardly remember a case of my own, in which symptoms of general rhachitis and of rhachitical softening of the cranium were absent in laryngismus; thus this much is certain, that the majority of cases of laryngismus, or crowing inspiration, depend on craniotabes and general rhachitis. It is always the great predisposing cause, and thus the last and proximate causes of an attack of our disease, as we find them enumerated in the text books, such as fright, anger, cough, protrusion of a tooth, etc., are thus assigned their right place of but occasional and temporary importance. By the defective condition of the cranium the brain is more subject to external injuries, concussion, quick movements of the head, improper carrying on the arm, lying on a hard pillow, rocking, and high temperature both artificial and solar; and finally, we must not overlook the importance of such

alterations as invariably take place, in rhachitis and craniotabes, in the nutrition of the system and the condition of the brain. At all events, you will hardly ever be mistaken in your etiology, when on meeting with a new case of laryngismus, you examine for craniotabes. Whenever a child with laryngismus is brought to me, my first attention is given to the occiput and epiphyses, as my first prescription is almost invariably the regulation of diet and the use of iron.

LECTURE XIII.

Therapeutics of Dentition.—Means of Alleviating Dentition.—Scarification of the Gums.

It has been the object of my lectures to prove that dentition is neither a disease nor a direct cause of diseases, except in very rare cases. I believe I have shown that all those diseases of the cutaneous, circulatory, respiratory, and nervous organs, generally attributed to dentition, are in no, or very loose, connexion with the physiological process of teething; that further, pathological occurrences cannot, in themselves, be accounted for by a simple and undisturbed physiological process; and finally, that disturbances are very rare indeed. It is, therefore, at least superfluous to more than mention these facts, as they are too fresh in your memory to require more than a mere reference to my former lectures. Now, if dentition is no disease, what right have I to speak of the therapeutics of dentition? I answer myself, that I have none. The diseases we have reviewed with each other, which were said to depend on dentition, require a treatment of some kind. But you have learned that their presumed dependency on dentition had not the least influence on their treatment. Thus we cannot even say that dentition, as it has not the slightest effect on the nature of those diseases, the etiology of which may be very complicated, has certainly none on their treatment.

Thus there is no treatment of dentition as such. Whatever treatment has been resorted to, has even in former times been very rarely of a general character. We should have to except from this general remark the common practice of purging by remedial agents such children as would not suffer from diarrhoea during the protrusion of a tooth or a group of teeth. But there are a number of local contrivances that have been resorted to, partially for the purpose of curing such diseases as were considered the consequences of dentition; partially, however, for their prevention. Among the latter I comprehend the articles prepared from leather, wood, bone, India-rubber, which are

destined to help the little ones in the work of the gradual absorption of the gums, or to relieve whatever annoying sensation they have or are supposed to have. I do not think that they can hurt, at all events I am not afraid of the inflammation which several authors suppose to follow the frequent use of these things. As to other means of alleviating or escaping the sufferings of dentition, every country, both civilized and barbarous, has invented its own; and what the instinct of the people did not furnish, has very frequently been sinned by those who ought to have known, and taught, better. Thus, according to Dr. Magaziner, the inhabitants of the regions around the Caspian Sea fill a quill with metallic mercury, and envelop it in a piece of leather or a woollen rag, in order to influence the secretion of milk in the female breast. Suspended over the chest, it is believed to increase the amount of milk, while it is believed to decrease when the metal is suspended on the back. This popular belief Dr. Smirnoff has attempted to transfer into practice and science on quite a different territory. He applied the same contrivance in cases of "difficult dentition," and succeeded so well, that he instantaneously made his discovery public. Up to this time the world has proved ungrateful. The modern Greeks, as we learn from the communications of Pr. Landerer, of Athens, to the Archives of Pharmacy (Oct. 1851), alleviate difficult dentition, and accelerate the protrusion of teeth, by daily frictions of the gums with the fresh brain of hares. A number of curious facts of a similar nature could be collected, if it was worth while in times where the brains of medical persons are still overtaxed to excel by some unexpectedly clever invention of their own. I have availed myself of some former opportunity to speak to you of Dr. Delabarre's Dentition Syrup, by which not only the tickling sensation of the gums of teething children is removed, but at the same time the immense number of diseases following this tickling sensation are prevented. It ranks with the numerous nostrums of the newspaper advertisements, and will, I hope, be forgotten with them.

Of the treatment of such diseases as have been believed to depend on dentition, I have spoken at different occasions, at the same time when I took some pains to elucidate their etiology; the measures for the purpose of preventing dis-

ease, by protecting the infantile organs, and by a proper diet, further, the measures for securing easy dentition, by securing general health, have repeatedly been the subject of our conversation. There is, however, one of the numerous means used for the purpose of alleviating dentition and curing dental diseases, on which I feel both bound and inclined to make a few remarks, viz. scarifications of the gums for the purpose of allowing a more rapid protrusion of a tooth, and thus affording protection or recovery from dangerous dental maladies.

Scarification of the gums has been practised for hundreds of years. Ambrose Paré lanced the gums of his own children. Harris, Van Swieten, and others, practised the same operation, but never before the gum would be stretched and prominent over the tooth, leaving its alveolus. They were of the opinion that the premature performance of the operation would be followed by a cicatrix of so solid a character that at a later time the tooth would find serious difficulties in piercing the gums. Benjamin Bell, however, and Richter, assert that deferring the operation until the period mentioned renders it entirely unnecessary; for the derangements following difficult dentition are perceptible before the piercing of the gums; therefore the gums must be lanced early in order to encounter the dangers of difficult dentition; if the incision were made prematurely, it might be repeated. Richter, moreover, believes the usefulness of lancing the gums to consist in the haemorrhage produced by this operation. Others advise to delay its performance until other means to check or remove morbid symptoms have failed. Girtanner praises it as the safeguard of many children who would have been lost without it; Camus, however, declares it to be both useless and injurious; he also doubts if the convulsions so generally attributed to the influence of difficult dentition really depend on the presumed cause.

The methods of the operation that have been recommended are just as various as the opinions concerning its value. One makes a single transverse incision, the other, a cross incision; others act in the former manner over the incisors, in the latter, before the appearance of the molars. Boyer removes the whole portion of the gum as far as it covers the tooth, attempting in this manner to avoid the



cacy of scarification of the gums in infants, and not in infants only, but in children. But the prevailing, I may say the universal, idea on this subject is, that we should lance the gums only when the teeth are ready to pierce through them, and only at the most prominent part of the gums, and as the occasion to which I have referred may require; and no idea of this important measure can be more inadequate to its real value. The process of teething is one of augmented arterial action and of vascular action generally; but it is also one of augmented nervous action; for formation, like nutrition, secretion, etc., generally, is always a nervo-vascular action; and of this the case in question is, from its peculiar rapidity, one of the most energetic. Like other physiological processes, it is apt to become, from that very character of energy, pathological, or of morbid activity. It is obviously, then, attended with extreme suffering to the little patient; the brain is irritable, and the child is restless and cross; the gums are tumid and heated; there is fever, an affection of the general vascular system, and there are, too frequently, convulsions of various degrees and kinds, manifested in the muscles which move the eyeball, the thumb and finger, the toe, the larynx, the parieties of the respiratory cavities; and the limbs and frame in general, affections of the excito-motor part of the nervous system, and of the secretion of the liver, kidneys, and intestines, affections of the ganglionic division of that system."

"It is to the base of the gums, not to their apex merely, that the scarification should be applied. The most marked case in which I have observed the instant good effect of scarification, was one in which all the teeth had pierced the gums. Better scarify the gums one hundred times unnecessarily, than allow the accession of one fit of convulsions from the neglect of this operation, which is equally important in its results, and trifling in its character. And it is not merely the prominent and tense gums over the edges of the teeth which should be divided; the gums, or rather the bloodvessels, immediately over the very nerves of the teeth, should be scarified and divided. Now, while there is fever or restlessness, or tendency to spasm, or convulsion, this local bloodletting should be repeated daily, and in urgent cases even twice a day. A skilful person does it in a minute, and in a minute often prevents a serious attack;

an attack which may cripple the mind, or the limbs, or even take the life of the little patient, if frequently repeated. There is, in fact, no comparison between the means and the end; the one is trifling, and the other so momentous."

"There is a phrase among nurses, *viz.* the breeding of teeth, which may be taken as evidence that *before* the teeth actually reach the borders of the gums, they may prove the source of much irritation."

Where "a phrase among nurses" is taken as "evidence," or where every case of convulsions is attributed to the process of dentition, because now and then a fit will occur in consequence of some irregularity in the protrusion of a tooth, we may have to expect such practice as recommended in the quotations you have just been listening to. It is true that a simple incision into the gums is generally not at all a dangerous thing, but to repeat the same operation to such an extent, to again and again divide the gums, appears both cruel and absurd. Moreover, Marshall Hall's own countrymen report cases of scarification of the gums made after his fashion, after which copious haemorrhages, suppurations, and ulcerations would take place. Not to speak of this fact, that all authors recommending frequent scarification were at the same time opposed to repeating it too frequently in rhachitic and scrofulous infants; but you know, that just these are the very ones who are most subject to the symptoms of what they call difficult dentition. Not to speak of the further fact, that the practice of both lancing the gums where you wish to avoid the trouble of making a diagnosis, and stopping to lance when you see no success, and therefore suspect some other cause of the morbid symptom, is unscientific and unworthy. Marshal Hall affirms never to have lost a child from difficult dentition—the greatest recommendation for his surgical cure of both difficult and easy dentition. I may state the same result of my own practice among teething infants, *viz.* that although I hardly make more than ten or twelve scarifications of gums in the course of a year, I have also never lost a case from "difficult dentition."

I see very few indications for the lancet during the period of dentition. You may cut where the gums are an impediment to the protrusion of a tooth, or where the gums themselves are the seat of a disease giving rise to general symptoms, especially of the nervous system. Thus, inflam-

mation of the gums justifies an incision, for the sake of relieving the tension of the tissue ; the same practice is followed in inflammations of the tongue, of the fingers, etc. Even mild cases in very irritable children may be treated in the same manner. But the incision itself, especially when repeated, may be a cause of irritation, sometimes visible in the fact that during the prevalence of follicular or other stomatitis the gums will be found covered with superficial ulcerations. I need not add, that while exudative processes, such as diphtheria, are active in the system, every wound of this description will give rise to new diphtheritic deposits. I, then, scarify the gum in cases of intense local hyperæmia and inflammation : these are the cases in which the loss of a few drops of blood, which have no effect on either the healthy or the diseased system in general, is decidedly advantageous. I should scarify, and have done so, several times during my practice, in cases of convulsions in tender, delicate, irritable patients, in whom I found the gums swollen, and where a correct diagnosis could not be made instantaneously ; especially in such as had been once relieved by the same operation ; for I must confess that once or twice in my life, not oftener, I have observed the instant termination of an attack of convulsions after I lanced the gums. But always be sure that the tooth is near the surface. I know that new cicatrices will easily tear, but old ones will not ; and I have seen real trouble arising from teeth that had been cut weeks before they were ready to pierce the gums ; if you mean to call it a piercing, for under normal circumstances the process is one of slow absorption of the gum. I have known cases in which practitioners had lanced the gums two or three months before the final appearance of the tooth, a practice which is annoying, or useless, or dangerous to the child, and certainly not indicative of much diagnostical power and therapeutical knowledge in the doctor. It is not even uncommon to find a retardation of the protrusion of a tooth where you expected its daily appearance. A child becomes sick, with the symptoms of fever, and some local symptoms which you will or will not diagnosticate, according to your accomplishments as a diagnostician. You lance the gums, and expect not only the appearance of the tooth, but also a termination of the untoward symptoms. Nothing of the kind occurs. To the contrary, the child gets thinner and sicker, and no

tooth. Where the system is intensely suffering, where emaciation takes place and nutrition is interfered with, it is but natural that the growth of a tooth should also stop. In such cases you may safely predict that no tooth will appear before the child will get well, or at least better. During convalescence the tooth cuts. You say that it made its appearance after the organism had been sufficiently restored to allow of phosphate of lime being spared for the building of teeth; the mother says, that because the child was well when the tooth came and was through, the child suffered from its tooth. You say, the child cut a tooth, after it was well enough. She says, it got well after it cut a tooth. Certainly there are difficulties in teething, but often during, not from.

In one of my first lectures I have spoken of the direct injury done to the tooth by incisions. The consistency of the tooth is the less the younger the child; and that harm is done to a tooth by the effect of a hard and sharp instrument cannot be denied. If you expect to effect anything by an incision, you must be sure of dividing it down to the tooth. But you can scarcely avoid injuring the tooth in cutting down upon it. If this danger exists, and it does exist, it is the more to be feared from those often-repeated scarifications recommended by Marshall Hall, and others. Thus while your incisions are of no use in the present, they are positively injurious to the future. There is something absurd and unworthy of the high standing of our profession in performing any, though slight, operation, which is useless; but it is a revolting thought to perform one that is worse than useless, viz. injurious. It is unworthy of the high vocation of our profession to resort to an action which gives the impression to the relations of the little sufferer, that not only something has been done, but that the right thing has been done, and which, nevertheless, is destined, in most cases, to cover the want of a diagnosis, and the ignorance regarding the causes of the disease. The language of disease in infantile life is intelligible enough. It is your province to listen to it, and to understand it.

THE END.



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